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EPA Superfund
Record of Decision:

OHIO RIVER PARK
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SUPERFUND PROGRAM
RECORD OF DECISION

Ohio River Park Site

Operable Unit Three
Neville Island
Allegheny County, Pennsylvania

September 1998
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RECORD OF DECISION

OHIO RIVER PARK SUPERFUND SITE

DECLARATION

I. SITE NAME AND LOCATION

Ohio River Park Superfund Site
Neville Township
Allegheny County, Pennsylvania

II. STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial action plan for the Ohio River Park Superfund Site (the "Site") in Allegheny County, Pennsylvania which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization act of 1986, 42 U.S.C. º 9601 ("SARA"), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"),40 C.F.R. Part 300. This decision is based upon and documented in the contents of the Administrative Record. The attached index identifies the items which comprise the Administrative Record.

The Commonwealth of Pennsylvania concurs with the selected remedy.

III. ASSESSMENT OF THE SITE

Pursuant to my duly delegated authority, I hereby determine, pursuant to Section 106 of CERCLA, 42 U.S.C. º 9606, that actual or threatened releases of hazardous substances from this Site, as specified in Section VII, Summary of Site Risks, in the ROD, if not addressed by implementing the response action selected, may present an imminent and substantial endangerment to the public health, welfare, or the environment.

IV. DESCRIPTION OF THE SELECTED REMEDY

The remedial action plan in this document is presented as the permanent remedy for controlling the groundwater at the Site. This remedy is comprised of the following components:

Monitoring of natural attenuation processes to measure changes in contaminant concentrations in groundwater plume at the Site until the cleanup levels are achieved.

D Deed restriction preventing residential use of groundwater at the Site.

V. STATUTORY DETERMINATIONS

Pursuant to duly delegated authority, I hereby determine that the selected remedy is protective of human health and the environment, complies with Federal and State requirements that legally are applicable or relevant and appropriate to the remedial action, and is cost-effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedial actions in which treatment that reduces toxicity, mobility, or volume is a principal element.

Because this remedy will result in hazardous substances remaining on site above health-based

levels, a review will be conducted within five (5) years after the commencement of the remedial action to ensure that human health and the envirorunent continue to be adequately protected by the remedy.

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RECORD OF DECISION
OHIO RIVER PARK SITE

PART II - DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

The Ohio River Park Site ("Site") includes appromimately 32 acres on the western end of Neville Island, approximately 10 miles downstream of the City of Pittsburgh (see Figure 1). The Main Channel of the Ohio River borders the 32-acre area to the north and the Back Channel of the Ohio River borders it to the south. The Site is accessible from the mainland via the new Coraopolis Bridge, linking the Town of Coraopolis with Neville Island. The Ohio River Park Site has been identified in some documents, mostly preceding EPA involvement, as Neville Island. This Record of Decision will refer to the Site as the "Ohio River Park Site" or "the Site."

The Ohio River Park Site is defined as all areas found presently, or in the future, to be impacted by contamination that resulted from waste disposal operations previously conducted at this 32-acre area on Neville Island. This ROD addresses the potential impact and fate of a plume of contaminated groundwater which originates at the Site and enters the Back Channel of the Ohio River and the impact of this plume on surface water and sediment.

Land use on Neville Wand is generally industrial/commercial, although some residential areas are present. The middle section of the island east of the Site and west of highway I-79 is mostly residential and commercial while the eastern end of the island is heavily industrialized. Most of Neville Island's 930 residents live in the area between the Coraopolis Bridge and highway I-79. The nearest residence is located approximately 450 feet from the Site. According to the 1990 census, the population within an approximately four-mile radius of the Site is 18,058. The eastern end of the island, approximately two miles east of the Site, is occupied by petrochemical facilities, coal coking facilities and abandoned steel facilities.

The Site consists primarily of open fields surrounded by trees and underbrush that form a perimeter adjacent to the river. The major structures on the Site in the Spring of 1998 included a maintenance building, asphalt-covered parking lots, roadways and walkways, concrete foundations, a pipeline, underground utilities, and an abandoned oil well derrick. These structures were demolished and replaced with the foundations for the Island Sports Center during the Spring/Summer of 1999.

The Site is located almost completely within the 100-year floodplain but above the ordinary high water elevation.

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II. SCOPE AND ROLE OF THE RESPONSE ACTION

EPA has divided the Site into three areas or Operable Units. The first operable unit includes approximately 31 acres owned by the Neville Land Company ("NLC"), and located

north of Grand Avenue and west of the Coraopolis Bridge. This operable unit is referred to as Operable Unit 1 ("OU-1") of the Site. Buried waste and soil contamination is present in this portion of the Site. EPA determined in a Record of Decision issued on September 30, 1996, that the required remedial action for OU-1 includes capping, surface water runoff controls, monitoring, and institutional controls.

The second operable unit ("OU-2") is an approximately one-acre area on the southeast comer of the Site that includes an approach roadway for the Coraopolis Bridge and a meadow along the Back Channel of the Ohio River. This area is also referred to as "the Bridge Portion of the Site" and is owned by Allegheny County. EPA determined that no cleanup action is required for OU-2 in a Record of Decision signed on March 31, 1993.

Operable Unit 3 ("OU-3") of the Site, the subject of this Record of Decision, addresses groundwater contamination for the entire Site. EPA initially planned to address these areas of concern as part of OU-1. After issuing the Proposed Plan for OU-1 and receiving public comments on the Agency's cleanup recommendations, EPA limited the scope of OU-1 to remediation of contamination in the buried waste and soil at the Site. Additional data were needed to select a final remedy to address contamination in the groundwater, surface water, and sediment at the Site. This Record of Decision identifies the required remedial action to address groundwater, surface water, and sediment contamination at the Site based on the additional data collected and information previously collected at the Site.

III. SITE HISTORY AND ENFORCEMENT ACTIVITIES

Prior to the 1940's, the predominant land use at the Site was agricultural. Beginning in the Mid-1930's until the mid-1950's, a portion of the Site was used for municipal landfill operations including the disposal of domestic trash and construction debris. Industrial waste disposal activities were conducted at the Site from 1952 through the 1960's.

Available information indicates that Pittsburgh Coke and Chemical Company ("PC&C") disposed of much of the industrial waste at the Site. PC&C began production of coke and pig iron on the eastern end of the island in 1929, operated a cement products plant during the 1930's, and produced coal coking by-products during the 1940's. Between 1949 and 1955, PC&C's agricultural Chemicals Division manufactured pesticides. Two methods of waste disposal were used by PC&C at the Site: wet wastes were placed into trenches and dry wastes were piled on the surface. Fifty-four trenches have been identified as being used for disposal of tar acid, tar decanter, and occasionally agricultural chemical wastes. Figures 2 and 3 show theapproximate disposal locations of various wastes at the Site. PC&C operations ceased in 1965-66. PC&C merged into Wilmington Securities, Inc., the parent corporation of the Neville Land Company ("NLC").

In 1977, Neville Land Company donated the Site area to Allegheny County. Allegheny County began construction of a park on the Site in 1977 and completed the construction in 1979, The park was never opened to the public, however, and was subsequently dismantled. During the course of the work, approximately 13,000 cubic yards of various wastes were discovered at the Site. Mile most of these materials were excavated and removed from the Site, some materials were reburied. After this discovery, Allegheny County transferred the title to the land back to NLC. A small portion of the property, which was acquired from another source to complete the park, was not transferred to NLC. Subsequently, by deed dated May 12, 1997, Allegheny County transferred this property to NLC.

Based on information and data collected from 1977 through 1989 by Allegheny County, EPA, NLC, and the Pennsylvania Department of Environmental Resources (("PADER"), now the Pennsylvania Department of Environmental Protection ("PADEP")), EPA proposed to include the Site on the National Priorities List of Superfund sites on October 16, 1999. The analytical data collected were used to evaluate the relative hazards posed by the Site using EPA's Hazard Ranking System ("HRS"). EPA uses the HRS to calculate a score for hazardous waste sites based upon the presence of potential and observed hazards. If the final HRS score exceeds 28.5, the Site may be placed on the National Priorities List, making it eligible to receive Superfund monies for remedial cleanup. This Site scored 42.24, and was placed on the list on August 30, 1990.

In October 1991, EPA and NLC, the owner of the Site, entered into an Administrative Order on Consent in which the NLC agreed to conduct a Remedial Investigation/Feasibility Study of the Site with EPA and State oversight. Field sampling was performed in 1992 and 1993, and the Remedial Investigation ("RI") Report for the Site was approved by EPA in June 1994. The Ecological Risk Assessment was completed in November 1994 and the Baseline Human Health Risk Assessment was completed in January 1995. Based on these documents, NLC submitted a Feasibility Study ("FS") in April 1995 describing the remedial action objectives and comparing cleanup alternatives for the Site. EPA issued the Record of Decision requiring remedial action for OU-1 on September 30, 1996. Through a Consent Decree entered on December 31, 1997, NLC and its parent, Wilmington Securities, Inc., agreed to Implement the remedy, which includes, capping, surface water runoff controls, monitoring, and institutional controls.

During the Spring of 1996, NLC proposed to submit additional data showing that reliance on natural attenuation processes would be an appropriate measure to address contaminants in the groundwater plume at the Site. EPA agreed to allow NLC to collect and submit the additional data as part of an intrinsic remediation demonstration study. Based on this study, NLC evaluated the results of groundwater sampling collected on and off the Site, including locations beneath the Back Channel and the sentinel well located across the Back Channel. The evaluation projected the fate and transport of contaminants in the groundwater plume by modeling of the biological, physical, and chemical mechanisms that can naturally lead to a reduction of the total mass of contaminants dissolved in groundwater.

IV. HIGHLIGHTS OF COMMUNITY PARTICIPATION

The documents which EPA used to develop, evaluate, and select a remedy for OU-3 of the Site are maintained at the Coraopolis Memorial Library, State and School Streets, Coraopolis, PA, and at the EPA Region 3, Philadelphia Office.

The Proposed Plan and supporting documents for OU-3 of the Site were released to the public for comment through a notice of availability published in the Tribune Review and Pittsburgh Post-Gazette on February 25, 1998. The 30-day public comment period ended on March 26, 1998.

EPA conducted a briefing for the Board of County Supervisors and a public meeting on March 17, 1998. EPA answered questions about the Site and the remedial alternatives under consideration during the public meeting. Approximately 100 people attended, including residents from the local community, local government officials, and news media representatives. A summary of comments received during the public comment period and EPA's responses are contained in Part III of this document.

V. SUMMARY OF SITE CHARACTERISTICS

A. Surface Features

Aerial photography and Remedial Investigation sampling revealed locations of dumping areas

and the types of wastes that were disposed at the Site (see Figures 2 and 3). Two methods of waste disposal were used: wet wastes were placed into 54 trenches and dry wastes were piled on the surface and/or incinerated at the Site. Most of the manufacturing and municipal wastes were disposed at the south-central portion of the Site beneath the currently existing parking lot, in the meadows, and along the Back Channel river banks. Steep river ledges at the western part of the Site were created by piles of foundry sand and demolition debris. From the mid-1960's until 1977, the Site was an abandoned landfill, Between 1977 and 1979, the Site was altered during the construction and then dismantling of a recreational park. Approximately 13,000 cubic yards of waste materials were excavated and the area was leveled and covered with soil. Natural revegetation occurred at the Site resulting in a cover of grass, shrubs and sporadic trees. Currently, the surface of the Site is being disturbed to implement the OU-1 remedy.

The Site is encircled by a metal fence with a gate at the entrance on Grand Avenue. An asphalt entry road (see Figure 4) leads to a portion of the Site where NLC started construction of the Island Sports Center in the Spring of 1998. The area was not used for waste disposal. The surfaces of the road, parking lots, and walking paths have not been maintained and are cracked in many places with several visible depressions and holes. The road goes further to a small parking lot where a former park administration building existed. This building was demolished in May 1998. NLC plans to build most of the Island Sports Center on the area between this parking lot and the Ohio River. The trees along the river banks have not been cleared during construction to protect steep slopes against erosion. The central portion of the Site includes open meadows and fragments of an old asphalt biking path. Along the river banks and at the western end of the island, trees and brush become denser and woods gradually replace the meadow. An abandoned oil well derrick, formerly located along the Ohio River bank in the north-central part of the Site, has been dismantled. The western portion of the Site, including the steep terraces on the river bank, is densely covered with trees.

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B. Geology

The Ohio River Park Site flies within the Allegheny Plateau section of the Appalachian Plateau Physiographic Province. The Allegheny Plateau is characterized by gently folded, parallel, northeast-southwest trending folds. At the Site, the bedrock is identified as the Glenshaw and Casselman Formations of the Pennsylvanian Age Connemaugh Group. These formations are primarily composed of interbedded shale, siltstone and sandstone with thin beds of limestone and coal. The Glenshaw Formation, which is the lower member of the Connemaugh Group, and the Casselman Formation, which is the upper member of the Connemaugh Group, are separated by the Ames Limestone in Western Pennsylvania.

Like most stream valleys in Western Pennsylvania, the Ohio River consists of unconsolidated sediments overlying bedrock. Neville Island is a portion of a dissected river terrace that was deposited by the ancestral Ohio River. The unconsolidated sediments at the Site are approximately 60 feet thick and in the Ohio River Channel 20 feet thick. At the Site, the upper portion of the unconsolidated sediments consists of approximately 25 feet of fill, and Quarternary fluvial deposits of clay, silt and sand. The lower 35 feet consists of glaciofluvial deposits of sand and gravel with minor amounts of silt and clay that were deposited from glacial meltwaters during the Pleistocene interglacial stages. The top of bedrock at the Site appears to gently slope toward the south-southwest.

Fill is found throughout the Site, with the exception of the eastern boundary where it is absent. Former trenches in the south-central portion of the Site extend to a maximum depth of 12 feet. Foundry sand disposed in the western part of the Site is up to 27 feet deep.

C. Hydrology

The Site is bounded by the Back Channel of the Ohio River to the south and by the Main Channel of the Ohio River to the north. The flow rate in the river has varied from 108,000 cubic feet per minute (measured at Sewickley in 1957) to 4,440,000 cubic feet per minute (measured at Sewickley in 1935). Since approximately 90 percent of the flow occurs in the Main Channel, the minimum and maximum flow in the Back Channel are approximately 10,800 and 44,400 cubic feet per minute, respectively. The Ohio River is navigable and chemicals, coal, and coke are routinely transported on the river by barges.

The Site terrace deposits, consisting of sand, gravel, and sediments, constitute an unconfined surficial aquifer that extends beneath the Ohio River and is interconnected to the river. Bedrock, consisting of shale, siltstone and fine-grained, micaceous sandstone, underlies these sediments. The groundwater in the sand/gravel aquifer beneath the Site discharges primarily to the Main and Back Channels of the Ohio River. However, this aquifer interconnects with groundwater beneath the river and on the shores. Groundwater is used as a source of drinking water by several municipalities which flank the Ohio River. The nearest one is the municipality of Coraopolis. The Coraopolis well field is located approximately 750 feet southwest from the western boundary of the Site, along the Back Channel. The well field consists of seven wells that produce an average of 127 cubic feet per minute from the sand and gravel aquifer.

D. Climate

The climate of Megheny County is classified as humid continental. The annual average precipitation is 37 inches, and it is evenly distributed throughout the year. The mean annual temperature is approximately 50 degrees Fahrenheit.

VI. NATURE AND EXTENT OF CONTAMINATION

The primary objective of the Remedial Investigation was to characterize the nature and extent of hazardous substances present at the Ohio River Park Site. As part of this effort, the RI identified and evaluated Site-related contaminants, their potential migration routes, and exposure pathways for human and ecological receptors. The results of groundwater presented in the RI indicated that natural attenuation processes could play an important role in changing the distribution and concentration of Site-related contaminants. To provide more information on natural attenuation, the intrinsic remediation demonstration study was completed using additional methods of investigation including water level monitoring, a pumping test, computer models of water flow, evaluation of geochemical indicators of natural attenuation, and plume evaluation. The predicted configuration of the plume was further modified by the data collected from additional sampling beneath the Ohio River Back Channel.

A. Groundwater Contamination in RI Report

During the RI, 17 new groundwater monitoring wells were installed at the Site to complement 19 existing on-site monitoring wells (see Figure 5A). One well from the Coraopolis Municipal Well Field was also sampled during the RI. The analytical data collected from these wells suggest benzene and phenolics are contaminants of concern in groundwater at the Site.

Pesticides and herbicides are not of concern based on the analytical data. Five pesticides were detected at five groundwater sampling locations, however, the concentrations detected were less than 0.02 parts per billion ("ppb"), This level is an order of magnitude (i.e., ten times) lower than the Safe Drinking Water Act Maximum Contaminant Level ("MCL") for the pesticides detected. Three herbicides were detected at the Site, however, only two samples detected an

herbicide (2,4-D) at a concentration exceeding its MCL (70 ppb).

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The inorganic data indicate that several metals were detected at levels of concern. Cadmium concentrations were greater than its MCL (5 ppb) at three monitoring well locations. Antimony was sporadically detected at concentrations greater than its MCL (6 ppb) at six monitoring wells. Antimony was not detected in the same monitoring wells during both groundwater sampling rounds and antimony was also detected in the laboratory blank samples, therefore, antimony was not considered a constituent of interest. Nickel was detected at concentrations greater than its MCL (100 ppb) at four monitoring well locations during both groundwater sampling rounds. Three of these monitoring well locations were in the areas of foundry sand disposal near the western end of the island.

Benzene is the volatile organic compound ("VOC") considered to be the primary contaminant of concern at the Site. Benzene was detected at concentrations ranging from 3 to 50,000 ppb in 22 of 36 samples analyzed. Benzene was detected primarily in 14 monitoring wells located in the southcentral portion of the Site.

Although an MCL has not been established for the phenolics, concentrations detected in the groundwater at the Site (>10 parts per million ("ppm")) indicate former disposal activities have impacted the groundwater quality in the south central portion of the Site. Phenolic compounds were detected at high concentrations near the southern portion of the large parking lot. The highest concentration of 2,4,6-Trichlorophenol was 210,000 ppb. Trace quantities of phenolics (generally <10 ppb) were detected in three of the five Back Channel monitoring wells. The high levels of 2,4,6-trichlorophenol suggest source material (ie., dense nonaqeous phase liquid ("DNAPL")), is present within the sand and gravel aquifer. The concentration of 2,4,6-trichlorophenol is approximately 20 percent of its reported solubility level in water. The highest concentranons of benzene occur in the southcentral portion of the Site west of the large parking lot, while the highest concentrations of 2,4,6-trichlorophenol occur near the southern portion of the large parking lot.

The groundwater analytical data suggest groundwater quality east of the Coraopolis Bridge has not been affected by previous disposal activities at the Site. No analytes exceeded MCL in groundwater east of the Coraopolis Bridge. Groundwater quality in the western and northern portions of the Site generally does not appear to have been adversely affected by previous disposal activities. Certain metals concentrations (e.g., nickel), however, exceed the MCL in areas where surface disposal of foundry sand occurred.

Groundwater monitoring data collected at the Site are summarized in Table 1 (Volatile Organic Compounds in Groundwater), Table 2 (Semi-volatile Organic Compounds in Groundwater), and Table 3 (Metals in Groundwater).

Table 1 - Volatile Organic Compounds in Groundwater

VOC	Detection Frequency (out of 80 samples)	Minimum Detected Concentration (ppb)	Maximum Detected Concentration (ppb)	Level of Concern (ppb)*
Methylene Chloride	6	0.85	5	4.1
Acetone	9	6	220	370
Chloroethane	1	-	38	3.6
Chlorobenzene	1	-	10	35
1,2-Dichloroethene	1	-	4.4	55
1,2-Dichloroethane	5	0.86	110	12
Tetrachloroethane	1	-	1.2	5(MCL)
1,1,1-Trichloroethane	2	1.9	4.3	200(MCL)
Trichloroethene	7	0.27	18	1.6
2-Butanone (MEK)	2	7	10	190
Carbon Disulfide	2	4	7	100
Benzene	25	3	50,000	5(MCL)
Toluene	4	3	7	1000 (MCL)
Xylenes	2	7	7.2	10000 (MCL)

* Level of Concern represents either drinking water standards (with connotation "MCL") or EPA Region III Risk-Based Concentrations. The latter ones are provided for the chemicals which do not have MCLs. The Risk Based Concentrations for carcinogenic chemicals (based on the concentration slope factor) represent a cancer risk of 10 -6. The Risk Based Concentrations for non-carcinogenic chemicals (based on the reference dose) represent a hazard quotient of 0.1. These numbers represent the threshold of risk and are provided for screening the contaminants historically detected at the Site.

Table 2 - Semivolatile Organic Compounds in Groundwater

SVOC	Detection Frequency (Out of 73 Samples)*	Minimum Detected Concentration (ppb)	Maximum Detected Concentration (ppb)	Level of Concern (ppb)**
Phenol	12	3	85,000	2200
2-Methylphenol	15	1	58,000	180
4-Methylphenol	21	2	76,000	18
2-Nitrophenol	1	-	1	
2,4-Dimethylphenol	7	17	6,700	73
2-Chlorophenol	14	1	36,000	18
2,4-Dichlorophenol	16	1	19,000	11
2,4,6-Trichlorophenol	13	1	210,000	6.1
Di-n-butylphthalate	1	-	1	370
Di-n-octylphthalate	4	1	12	73
Bis(2-ethylhexyl) phthalate	9	1	170	0.48
Naphthalene	1	-	1	150

* Excluding field blank samples

** Level of Concern represents either drinking water standards (with connotation "MCL") or EPA Region III Risk-Based Concentrations. The latter ones are provided for the chemicals which do not have MCLs. The Risk Based Concentrations for carcinogenic chemicals (based on the concentration slope factor) represent a cancer risk of 10 -6. The Risk Based Concentrations for non-carcinogenic chemicals (based on the reference dose) represent a hazard quotient of 0.1. These numbers represent the threshold of risk and are provided for screening site contaminants historically detected at the Site.

Table 3 - Metals in Groundwater

compound	Detected Frequency (out of 71 samples	Minimum Detected Concentration (ppb)	Maximum Detected Concentration (ppb)	Level of Concern (ppb)*
Aluminum	41	16.3	26,900	200 (SMCL)
Antimony	6	22.4	97.8	1.5
Arsenic	13	2	29.3	0.045
Barium	71	13.1	8,050	260
Beryllium	3	1.1	9.5	7.3
Cadmium	8	3.5	14.7	1000 (SMCL)
Calcium	71	27,000	674,000	
Chromium	14	6	29.8	18
Cobalt	30	8.1	441	220
Copper	4	5.2	12.8	1000 (SMCL)
Iron	53	12.6	460,000	300 (SMCL)
Lead	1	-	2	15
Magnesium	71	390	199,000	
Manganese	67	4	192,000	73
Mercury	3	0.14	0.55	1.1
Nickel	36	11.2	870	73
Potassium	71	253	25,800	
Selenium	0	-	-	18
Silver	9	8.4	29.3	100 (SMCL)
Sodium	71	5,180	178,000	
Thallium	0	-	-	26
Vanadium	3	6.7	18.2	26
Zinc	34	7.7	5,320	5000(SMCL)
Cyanide	32	5.1	335	73

* Level of Concern represents either drinking water standards (with connotation "SMCL") or EPA Region III Risk-Based Concentrations. The latter ones are provided for the chemicals which do not have MCLs. The Risk Based Concentrations for carcinogenic chemicals (based on the concentration slope factor) represent a cancer risk of 10 -6. The Risk Based Concentrations for non-carcinogenic chemicals (based on the reference dose) represent a hazard quotient of 0.1. These numbers represent the threshold of risk and are provided for screening site contaminants historically detected at the Site.

B. Groundwater Contamination in Intrinsic Remediation Demonstration Study

NLC submitted its Intrinsic Remediation Demonstration Study (IRD) proposal to EPA in October 1996. The purpose of the study was to collect data to evaluate natural attenuation processes that may be occurring at the Site. EPA, in consultation with PADEP, commented on the proposal and revisions were incorporated as the study progressed. The revised proposal and EPA's comment letters have been included in the Administrative Record. A supplemental study to evaluate the quality of the groundwater beneath the Back Channel of the Ohio River was also performed and the final report is included in the Administrative Record. All this documentation is referred to collectively in this Record of Decision as the OU3 study. The OU3 study demonstrates that natural attenuation is occurring at rates sufficient to be protective of human health and the environment. The study pinpoints the extent and fate of the plume by sampling, evaluating, and modeling biological, physical and chemical aspects of the natural attenuation processes.

The OU3 study is divided into two separate, but related components: (1) the evaluation of the extent and stability of the plume, and (2) the evaluation of the fate and transport of the plume in relationship to the Coraopolis public drinking water well field. The tasks performed for the first component of the study include:

- D Evaluation of existing monitoring well operability and initial (May 1996) sampling;
- D Drilling and installation of nine new monitoring wells;
- D Groundwater sampling and analysis of 37 monitoring wells;
- D Assessment of past and present plume configuration;
- D Analysis of redox reactions based on electron acceptor relationships.

The tasks performed for the second component of the OU3 study were the following:

- D Analysis of aquifer parameters;
- D Water level monitoring;
- D Flow net analysis;
- D Pumping test at Coraopolis well field;
- D Development of a three-dimensional groundwater flow model;
- D Solute transport modeling;
- D Evaluation of mass balance;
- D Evaluation of mass loading to surface water;
- D Sampling aquifer beneath the Back Channel.

The nature and the extent of groundwater contamination at the Site based on the OU3 study is summarized below.

1. Aquifer Characteristics

To characterize the relationship between the aquifer at the Site and the aquifer at the Coraopolis well field, a pumping and recovery test was conducted using the Coraopolis production wells. The Coraopolis well field consists of three primary supply wells (Wells 2, 6, and 8) and four backup wells. The annual average production rate for the system is approximately 850,000 gallons per day ("gpd"). Above average pumping rates were used to evaluate whether the contaminated plume at the Site could potentially influence the municipal wells. The test results indicate that the aquifer at the Coraopolis well field exhibits the characteristics of a partially confined or leaky confined alluvial aquifer with a low storage capacity and low transmissivity. No measurable hydraulic connection between the Coraopolis well field and the Site was observed with the increased rate of pumping. Groundwater fluctuations in

the Site wells closely matched fluctuations in the Ohio River, indicating a high degree of hydraulic interconnection and the river's domination over groundwater flow in the aquifer.

To further evaluate whether the groundwater pumping at the Coraopolis well field has the potential to capture groundwater originating at the Site, the OU3 study includes a three-dimensional groundwater flow model called the FTWORK model. The FTWORK model shows that the Ohio River is the source of virtually all of the water captured by the Coraopolis well field. Although sensitivity analysis shows that groundwater could theoretically flow from the Site to the Coraopolis well field, the estimated contribution of water from the Site would be less than 0.2 percent of the total groundwater flow.

2. Extent of the Plume

To determine the southern extent of the plume of contaminated groundwater at the Site, NLC collected 13 groundwater samples in August 1997 at nine locations south of the western tip of Neville Island beneath the Ohio River Back Channel (see Figure 5B). The sampling locations were approved by EPA after consultation with PADEP. Because benzene and phenolics are the most prevalent compounds in the plume, benzene and 2,4,6-trichlorophenol were used as indicator parameters for defining the extent of the plume. Benzene was detected in samples from one location at concentrations of 6.7 ppb and 1.0 ppb. Other VOCs detected were toluene (four samples), xylenes (one sample), carbon disulfide (one sample), and 22-hexanone (one sample), all at concentrations below MCLs. Two phenolic compounds were detected at concentrations below the level that can be measured with certainty. Their concentrations were estimated to be 1/10th of the analytical detection limit. 4-Methylphenol was detected in one sample and 2,4-dimethyl phenol was detected in three samples. No other phenolic compounds were detected.

The distribution of the benzene concentrations in the Back Channel in the mid-depth portion of the aquifer (see Figure 6) and the deeper portion of aquifer (see Figure 7) confirms that the plume is limited to the southern shore of Neville Island with little contamination

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migrating to the south. The concentrations and distribution of xylenes, toluene, and phenolics are also limited to beneath the former disposal areas, as defined in the RI and OU3 study,

The results of the OU3 study indicated that both the size of the plume and the concentrations of its main contaminants are being stabilized or reduced in time. The OU3 study focused on two Site-related contaminants of concern in the plume: benzene and 2,4,6-trichlorophenol. To allow comparison with historical data, the OU3 groundwater sampling also includes analysis for the same VOCs and semi-volatile organic compounds ("SVOCs") as the RI Report. A comparison of RI and OU3 study results is presented in Tables 4 and 5. The tables show virtually no change in the plume character based on the number and type of constituents detected between 1993 and 1996.

The benzene plume, located beneath the trench area, is elliptical in shape and oriented southeast-northwest in the shallow, mid-depth, and deep groundwater. The plume area has decreased steadily over time. The current plume is smaller than the benzene plumes observed in 1981, 1984, 1987, and 1993 (see Figures 8, 9, 10 and 11). The coal coking sludge that was disposed at the Site is considered to be the main source of benzene. The boundary of the 1996 benzene plume (see Figure 12) coincides with the area where sludge disposal occurred and confirms that the plume has remained stable. The concentration and distribution of VOCs and phenolics (see Figure 13), showed a pattern similar to the results of the RI Report.

3. Natural Attenuation of the Plume

A major task of the OU3 study was to demonstrate the presence and extent of active biodegradation processes within the plume, the effectiveness of biodegradation in controlling the development of the plume, and establishing rates of biodegradation. The primary objective of the study was to develop a predictive model for the fate and transport of contaminants that could be used to demonstrate the long-term effectiveness of natural attenuation processes occurring at the Site. Natural attenuation processes were evaluated by (1) sampling the groundwater for key contaminants and their degradation products to assess how the plume has changed over time, and (2) comparing the analytical data with specific geochemicad indicators to verify whether active biodegradation is occurring within and at the boundaries of the plume.

Biodegradation processes rely on naturally occurring microbes that use chemical compounds as a source of energy. Biodegradation is accomplished by a series of chemical reactions taking place in very slowly flowing groundwater. The order of these reactions depends mostly upon the amount of energy that they produce; those reactions that produce the greatest amount of energy occur first. As the higher energy reactions are completed, the reactions generating the next lowest amount of energy will occur. The first reactions use oxygen (aerobic reaction) and occur as long as enough dissolved oxygen is present. After the dissolved oxygen is depleted, a series of anaerobic reactions occur using nitrate, manganese, ferric iron, sulfate, and carbon dioxide sequentially in place of oxygen. As a result of these microbially mediated reactions, the substances in the groundwater that can be used as sources

Table 4 - Comparison of VOC Concentrations in RI and OU3 Study

VOC	Detection Frequency RI (n = 80)	Detection Frequency IRD (n = 39)	Minimum Detected Concentration (ug/L) RI	Minimum Detected Concentration (ug/L) IRD	Maximum Detected Concentration (ug/L) RI	Maximum Detected Concentration (ug/L) IRD
2-Butanone	2	3	7 J	5.4	101	2.200
Acetone	9	2	6 J	330 E	220	1.500 E
Benzene	25	16	3 J	9.8	50.000	210.000
Carbon disulfide	2	2	4 J	4.2 J	7 J	17
Chlorobenzene	1	3	-	3.5	10 J	14
Chloroethane	1	1	-	-	38	29
1,2-Dichloroethane	5	0	0.86	-	110 J	-
1,2-Dichloroethene	1	0	-	-	4.4	-
Ethylbenzene	0	2	-	120	-	170
Methylene chloride	6	2	0.85 B	3.8	5.1	4.3
Tetrachloroethene	1	0	-	-	1.2	-
Toluene	4	5	3 J	3.6	7 J	18.000
1,1,1-Trichloroethane	2	0	1.9	-	4.3	-
Trichloroethene	7	0	0.27	-	18	-
Xylenes	2	3	7 J	5.6	7.2 J	1.600 E

E = Quantification beyond calibration range
J = Estimated concentration

Table, 5 - Comparison of SVOC Concentrations in RI and OU3 Study

	Detection Frequency		inimum Detected Concentration (ug/L)		Maximum Detected Concentration (ug/L)	
	RI (n = 73)	IRD (n = 7)	RI	IRD	RI	IRD
2-Chlorophenol	14	4	1 J	6.4	36,000 J	6,000
2,4-Dichlorophenol	16	5	1 J	13	19,000 J	25,000
2,4-Dimethylphenol	7	5	17 J	3.7	6,700 J	21,000
2-Methylphenol	15	5	1 J	1	58,000	32,000
4-Methylphenol	21	5	2 J	2.9	76,000	37,000
2-Nitrophenol	1	0	-	-	1 J	-
Phenol	12	7	3 J	34	85,000	14,000
2,4,6-Trichlorophenol	13	5	1 J	1.2	210,000	130,000

J = Estimated concentration

<IMG SRC 98046J>
<IMG SRC 98046K>
<IMG SRC 98046L>
<IMG SRC 98046M>
<IMG SRC 98046N>
<IMG SRC 98046O>

of energy are depleted and the concentrations of the natural attenuation by-products increase.

The OU3 study analyzed the following parameters to track the progression of the natural attenuation processes: dissolved oxygen, nitrate, sulfate, dissolved manganese, dissolved iron, methane, and carbon dioxide. The study found that along the margins of the plume, a zone of the depleted dissolved oxygen is present (see Figure 14). The existence of this zone indicates that aerobic degradation is occurring along the margins of the plume, The depletion of dissolved oxygen to concentrations to less than 0.5 milligrams per liter ("mg/l") within the the plume indicates that biodegradation is also occurring in the plume interior. The accumulation of metabolic by-products in the vicinity of the plume also provides evidence of anaerobic processes. These by-products include dissolved manganese, dissolved iron, carbon dioxide, and alkalinity. Modeling performed by NLC and independently by the EPA Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma, agrees that sulfate makes an excellent tracer of the plume location and natural attenuation reactions taking place within the plume. The leading edge of elevated sulfate and natural attenuation by-products (e.g., dissolved manganese and iron) extends 300-400 feet beyond the leaqding edge of the benzene plume and is a measurable demonstration that biodegradation is constraining migration of the plume by destruction of organic constituents.

While the intrinsic remediation demonstration focused on the natural attenuation of benzene, other organic constituents present in the groundwater at the Site (e.g., 2,4,6-trichlorophenol, toluene, ethylbenzene, and xylenes) also biodegrade in a same or similar manner as benzene. The selection of benzene as the primary focus of the study was appropriate given the limited occurrence of these other compounds in the plume.

VII. SUMMARY OF SITE RISKS

As part of the RI/FS performed for the Site, analyses were conducted to estimate the human health and environmental hazards that could result if contamination at the Site is not cleaned up. These analyses are commonly referred to as Risk Assessments and identify existing and future risks that could occur if conditions at the Site do not change. The Baseline Human Health Risk Assessment ("BLRA") evaluated human health risks and the Ecological Risk Assessment ("ERA") evaluated environmental impacts from the Site.

A. Human Health Risks

The BLRA assesses the toxicity, or degree of hazard, posed by contaminants, related to the Site, and involves describing the routes by which humans and the ecological receptors could come into contact with these substances. Separate calculations are made for those substances that can cause cancer (carcinogenic) and for those that can cause non-carcinogenic, but adverse, health effects. In general, a baseline risk assessment is performed in four steps: (1) data collection and evaluation, (2) exposure assessment (3) toxicity assessment, and (4) risk characterization. Each of these steps is explained further below.

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1. Data Collection and Evaluation

The data collected during the RI were evaluated for use in the BLRA, This evaluation involved reviewing the quality of the data to determine which are appropriate to use to quantitatively estimate the risks associated with Site soil, sediment, surface water, and groundwater. The concentrations used to determine human health risks are derived by averaging the data for each media and then calculating the upper 95th percentile confidence limit. By using this upper confidence limit, EPA can be 95% certain that the true average concentration

does not exceed this level. This concentration is referred to as the reasonable maximum exposure ("RME") concentration because an individual would not reasonably be expected to be exposed to a higher concentration. The RME values calculated based on the Site data are summarized in Table 6.

Table 6 - Reasonable Maximum Exposure Point Concentrations

Contaminant	Surface Soil (mg/kg)	Sub-surface Soil (mg/kg)	Ground-water (mg/L)	Surface Water (mg/L)	Sediment (mg/kg)	Fish (mg/kg)
2,4-D			7.24E-02			
alpha-BHC	2.32E-01	3.78E+00				
beta-BHC	1.95E-01	3.22F+00				
delta-BHC			1.54E-03			
gamma-BHC	2.69E-01					
Aldrin	5.35E-02					
Dieldrin	5.59E-02		3.09E-09			
Endosulfan sulfate		3.16E-01				
gamma-chlordane	8.78E-02			2.51E-05		3.51E-01
Arochlor-1254					1.52E-01	
Arochlor-1260	5.21E-01	1.77E+00				
Phenol			5.26E+01			
2-Chlorophenol			5.23E+00			
2-Methylphenol			4.01E+01			
4-Methylphenol			5.37E+01			
2,4-Dichlorophenol			2.47E+01			
2,4,6-Trichlorophenol			1.08E+02			

Table 6 - Reasonable Maximum Exposure Point Concentrations

Contaminant	Surface Soil (mg/kg)	Sub-surface Soil (mg/kg)	Ground-water (mg/L)		Surface Water (mg/L)	Sediment (mg/kg)	Fish (mg/kg)
Carbon disulfide			1.45E+00				
1,2-Dichloroethane			1.44E+00				
Trichloroethene			1.45E+00				
1,1,2-Trichloroethane			1.45E+00				
Benzene			2.19E+01				
Chlorobenzene			1.45E+00				
Naphthalene	2.39E+01						
Benzo(a)anthracene	6.36E+00	2.03E+00					
Chrysene	5.55E+01						
Benzo(b)fluoranthene	8.32E+00	2.54E+00					
Benzo(k)fluoranthene	2.98E+00						
Benzo(a)pyrene	5.10E+00	1.37E+00					
Indeno(1,2,3-cd)pyrene	3.82E+00	1.00E+00					
Dibenz(a,h)anthracene	1.84E+00	9.53E-01			2.25E+00		
Benzo(g,h,i)perylene	3.53E+00						
Aluminum	1.55E+04	1.78E+04	1.77E+01				
Antimony			1.32E-02			1.55E-02	
Arsenic	1.18E+01		4.19E-03		1.48E+01	8.80E-02	
Barium	2.31E+02		3.67E-01				
Beryllium	1.67E+00	2.45E+00	3.54E-03		2.91E+00	9.50E-03	
Cadmium			7.46E-03				
Chromium	2.80E+01		9.44E-03	9.85E-03	7.57+01	1.58E-01	
Cobalt			2.20E-01			3.50E-03	
Copper	6.72E+01						
Cyanide	1.84E+01						
Manganese	1.95E+03	1.58E+03	7.82E+01		2.62E+03	1.80E+01	

Table 6 - Reasonable Maximum Exposure Point Concentrations

Contaminant	Surface Soil (mg/kg)	Sub-surface Soil (mg/kg)	Ground-water (mg/L)	Surface Water (mg/L)	Sediment (mg/kg)	Fish (mg/kg)
Mercury	8.27E-01			3.49E-04		1.92E+00
Nickel			1.56E-01			
Thallium	8.62E-01					
Silver			1025E-02			
Vanadium	3.88E+01					
Zinc			3.32E+00		1.77E+03	

2. Exposure Assessment

An exposure assessment involves three basic steps: 1) identifying the potentially exposed populations, both current and future; 2) determining the pathways by which these populations could be exposed; and 3) quantifying the exposure. Under Site conditions prior to cleanup, the BLRA identified the following populations as having the potential for exposure to Site-related contaminants, either currently and/or in the future:

- ò future residents living on the Site;
- ò current and/or future off-site residents;
- ò current and/or future recreational users of the Site;
- ò future commercial or industrial workers at the Site; and
- ò trespassers.

Future residents living on the Site have the potential for exposure to Site-related contaminants through (1) ingestion of soil, sediments, surface water, groundwater, and fish, (2) direct contact with surface water; and (3) inhalation of water vapor during showering. If the future residents obtain drinking water through a public drinking water supply, the groundwater ingestion and inhalation pathways would be eliminated. For off-site residents, similar exposure pathways exist, however, the overall potential for exposure is less. Off-site residents would only be exposed to Site soils during recreational use of the Site and their exposure to Site-related contaminants in drinking water supplies would be substantially reduced.

Recreational users of the Site have the potential for exposure to Site-related contaminants through ingestion of fish, surface water, soil, and sediment as well as through direct contact with surface water. Workers at the Site could be exposed to contaminants through ingestion of Site soil and by drinking groundwater unless drinking water is provided through a public water supply. Trespassers have potential for exposure through ingestion and direct contact with Site surface water and through ingestion of Site soil.

In order to quantify the potential exposure associated with each pathway, assumptions must be made for the various factors used in the calculations. Table 7 summarizes the values used in the BLRA.

Table 7 - Exposure Assessment Factors

Exposure Factors	Soil	Sediment	Surface Water	Groundwater	Fish
INGESTION EXPOSURE PATHWAY					
Ingestion Rate:					
Adult	100 mg/day	100 mg/day	2 liters/day	2 liters/day	54 g/day
Child	200 mg/day	200 mg/day	1 liter/day	1 liter/day	20 g/day
Adult Worker	50 mg/day			2 liters/day	
Adolescent	100 mg/day		0.5 liters/day		
Exposure Frequency (EF):					
Resident	350 days/year		350 days/year	350 days/year	
Recreational	20 days/year	20 days/year	7 days/year		350 days/year
Worker	250 days/year			250 days/year	
Trespasser	50 days/year		7 days/year		
DERMAL CONTACT EXPOSURE PATHWAY					
Skin Surface Area:					
Adult			18,000 cm 3		
Child			7,200 cm 3	7,200 cm 3	
Adolescent			16,000 cm 3		
EF:					
Recreational			7 days/year		
Trespasser			7 days/year		
Child Bathing			350 days/year	350 days/year	
Bath Duration:			0.33 hours/day	0.33 hours/day	
INHALATION EXPOSURE PATHWAY					
Inhalation Rate: Adult			0.0139 m 3/min	0.0139 m/min	
EF:			350 days/year	350 days/year	
Shower Duration:			12 min/day	12 min/day	

Table 7 - Exposure Assessment Factors

Exposure Factors	Soil	Sediment	Surface Water	Groundwater	Fish
EXPOSURE ASSESSMENT CONSTANTS					
Exposure Duration:					
Adult resident	24 years	24 years		24 years	
Adult worker	25 years	1 year		25 years	
Child resident	6 years	6 years		6 years	
Adolescent trespasser	6 years				
Body Weight:					
Adult	70 kg				
Child	15 kg				
Adolescent	55 kg				

Averaging Time:	Carcinogens:	Noncarcinogens:
Adult resident	70 years	24 years
Child resident	70 years	6 years
Adult worker	70 years	25 years
Trespasser	70 years	6 years

3. Toxicity Assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for particular contaminants to cause adverse effects in exposed individuals. Where possible, the assessment provides a quantitative estimate of the relationship between the extent of exposure to a contaminant and the increased likelihood and/or severity of adverse effects.

A toxicity assessment for contaminants found at a Superfund site is generally accomplished in two steps: 1) hazard identification, and 2) dose-response assessment. Hazard identification is the process of determining whether exposure to an agent can cause an increase in the incidence of a particular adverse health effect (e.g., cancer or birth defects) and whether the adverse health effect is likely to occur in humans. It involves characterizing the nature and strength of the evidence of causation. Dose-response evaluation is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the contaminant administered or received and the incidence of adverse health effects in the administered population.

From this quantitative dose-response relationship, toxicity values (e.g., reference doses and slope factors) are derived that can be used to estimate the incidence or potential for adverse effects as a function of human exposure to the agent. These toxicity values are used in the risk characterization step to estimate the likelihood of adverse effects occurring in humans at different exposure levels.

For the purpose of the risk assessment, contaminants were classified into two groups: potential carcinogens and noncarcinogens. The risks posed by these two types of compounds are assessed differently because noncarcinogens generally exhibit a threshold dose below which no adverse effects occur, while no such threshold can be proven to exist for carcinogens. As used here, the term carcinogen means any chemical for which there is sufficient evidence that exposure may result in continuing uncontrolled cell division (cancer) in humans and/or animals. Conversely, the term noncarcinogen means any chermical for which the carcinogenic evidence is negative or insufficient.

Slope factors have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic contaminants of concern. Slope factors, which are expressed in units of (kgòd/mg) are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied to account for the use of animal data to predict effects on humans. Slope factors used in the baseline risk assessment are presented in Table 8.

Reference doses ("RfDs") have been developed by EPA to indicate the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of acceptable lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of contaminants of concern from human epidermiological studies or animal studies to which uncertainty factors have been applied account for the use of animal data to predict effects on humans. Reference doses used in the baseline risk assessment are presented in Table 8.

4. Human Health Effects

The health effects of the Site contaminants that are most associated with the unacceptable risk levels are summarized below. In most cases, the information in the summaries is drawn from the Public Health Statement in the Agency for Toxic Substances and Disease Registry's (ATSDR) toxicological profile for the chemical.

Aldrin & Dieldrin: The carbamate insecticide Aldrin exists as a colorless crystalline solid at room temperature, having a molecular weight of 365 and melting point of 104 C. It is highly soluble in non-polar solvents but only slightly soluble in water. Aldrin is readily taken into the body via inhalation, dermal absorption, ingestion or eye contact. EPA considers aldrin to be a Class B2 carcinogen because it causes tumors in rats and mice. Aldrin also causes birth defects and damage to the reproductive system, liver toxicity, and central nervous system abnormalities following chronic exposure. It is also acutely toxic, with an oral LD50 (i.e., dose which is lethal to 50% of the test animals in research studies) of about 50 mg/kg. Aldrin is highly toxic to

Table 8 - Slope Factors and Reference Doses

	Slope factors (kgòd/mg)		Reference Doses (mg/kg/d)	
Chemical	Oral	Inhaled	Oral	Inhaled
2,4-D			1.00E-02	
alpha-BHC	6.30E+00	6.30E+00		
beta-BHC	1.80E+00	1.80E+00		
delta-BHC	1.80E+00	1.79E+00		
gamma-BHC	1.30E+00		3.00E-04	
Aldrin	1.70E+01	1.72E+01	3.00E-05	
Dieldrin	1.60E+01	1.61E+01	5.00E-05	
Endosulfan sulfate			6.00E-03	
gamma-chlordane	1.30E+00	1.30E+00	6.00E-05	
Arochlor-1254	7.70E+00			
Arochlor-1260	7.70E+00			
Phenol			6.00E-01	
2-Chlorophenol			5.00E-03	
2-Methylphenol			5.00E-02	
4-Methylphenol			5.00E-03	
2,4,-Dichlorophenol			3.00E-03	
2,4,6-Trichlorophenol	1.10E-02	1.09E-02		
Carbon disulfide			1.00E-01	2.86E-03
1,2-Dichloroethane	9.10E-02	9.10E-02		2.86E-03
Trichloroethene	1.10E-02	6.00E-02	6.00E-03	
1,1,2-Trichloroethane	5.70E-02	5.60E-02	4.00E-03	
Benzene	2.90E-02	2.91E-02		1.43E-04
Chlorobenzene			2.00E-02	5.71E-03
Naphthalene			4.00E-02	
Benzo(a)anthracene	7.30E-01	6.10E-01		
Chrysene	7.30E-03	6.10E-03		
Benzo(b)fluoranthene	7.30E-01	6.10E-01		
Benzo(k)fluoranthene	7.30E-02	6.10E-02		
Benzo(a)pyrene	7.30E+00	6.10E+00		
Indeno(1,2,3-cd)pyrene	7.30E-01	6.10E-01		
Dibenz(a,h)anthracene	7.30E+00	6.10E+00		
Benzo(g,h,i)perylene				
Aluminum			2.90E+00	
Antimony			4.00E-04	
Arsenic	1.75E+00	1.51E+01	3.00E-04	
Barium			7.00E-02	1.43E-04
Beryllium	4.30E+00	8.40E+00	5.00E-03	
Cadmium		6.30E+00	5.00E-04	
Chromium		4.20E+01	5.00E-03	
Cobalt				
Copper			3.71E-02	
Cyanide			5.00E-03	
Manganese			5.00E-03	1.14E-04
Mercury			3.00E-04	8.57E-05
Nickel			2.00E-02	
Thallium			8.00E-05	
Silver			5.00E-03	
Vanadium			7.00E-03	
Zinc			3.00E-01	

aquatic organisms, and has been associated with large-scale kills of terrestrial wildlife in treated areas.

Antimony: Antimony can enter the body by absorption from the gastrointestinal tract following ingestion of food or water containing antimony, or by absorption from the lungs after inhalation. Ingestion of high doses of antimony can result in burning stomach pains, colic, nausea, and vomiting. Long-term occupational inhalation exposure has caused heart problems, stomach ulcers, and irritation of the lungs, eyes, and skin. The critical or most sensitive noncarcinogenic effects of exposure to antimony are shortened life span, reduced blood glucose levels, and altered cholesterol levels. Existing data suggest that antimony may be an animal carcinogen but are not sufficient to justify a quantitative cancer potency estimate at this time. In laboratory rats, inhalation of antimony dust can increase the risk of lung cancer. However, there is no evidence of increased risk of cancer to animals from eating food or drinking water containing antimony. It is not known whether antimony can cause cancer in humans.

Arsenic: Arsenic is a metal that is present in the environment as a constituent of many organic and inorganic compounds. Arsenic is a known human carcinogen implicated in skin cancer in humans. Inhalation of arsenic by workers is known to cause lung cancer. Arsenic compounds cause chromosome damage in animals, and humans exposed to arsenic compounds have an increased incidence of chromosomal aberrations. Arsenic compounds are reported to be teratogeruc, fetotoxic, and embryotoxic in some animal species. Dermatitis and associated lesions are attributable to arsenic coming into contact with the skin, with acute dermatitis being more common than chronic. Chronic industrial exposures may be characterized by hyperkeratosis, and an accompanying hyperhidrosis (excessive sweating usually of the palms and soles of the feet).

Benzene: Benzene is readily absorbed by inhalation and ingestion, but is absorbed to a lesser extent through the skin. Most of what is known about the human health effects of benzene exposure is based on studies of workers who were usually exposed for long periods to high concentrations of benzene. Benzene is toxic to blood-forming organs and to the immune system. Excessive exposure (inhalation of concentrations of 10 to 100 ppm) can result in anemia, a weakened immune system, and headaches. Occupational exposure to benzene may be associated with spontaneous abortions and miscarriages (supported by limited animal data), and certain developmental abnormalities such as low birth weight, delayed bone formation, and bone marrow toxicity. Benzene is classified as a Group A human carcinogen based on numerous studies documenting excess leukemia mortality among occupationally exposed workers.

Beryllium: The respiratory tract is the major target of inhalation exposure to beryllium. Short-term exposure can produce lung inflammation and pneumonia-like symptoms. Long-term exposure can cause berylliosis, an immune reaction characterized by noncancerous growths on the lungs. Sirmilar growths can appear on the skin of sensitive individuals exposed by dermal contact. Epidemiological studies have found that an increased risk of lung cancer may result from exposure to beryllium in industrial settings. In addition, laboratory studies have shown that breathing beryllium causes lung cancer in animals. However, it is not clear what cancer risk, if any, is associated with ingestion of beryllium. EPA has classified beryllium as a Group B2 probable human carcinogen based on the limited human evidence and the animal data.

Chlordane: Chlordane can be absorbed by the body through dermal contact, inhalation of particulates in ambient air, and ingestion of contaminated food or soils. It may remain stored for months or years in the blood plasma or the body fat of the liver, spleen, brain, and kidneys. Little data are avaialable on the adverse health effect of chlordane exposure in humans. Symptoms associated with human overexposure to this compound include headache, dizziness, lack of coordination, irritability, weakness, and convulsions. In humans, an acute oral lethal dose of chlordane was estimated to be between 25 and 50 mg/kg. Experimental studies exploring the health effects on animals exposed to various levels of chlordane showed an

association between exposure and immunologic dysfunction, reproductive dysfunction, nervous system damage, liver damage, convulsions, liver cancer, and death. The lethal dose of chlordane in rats is estimated to be between 85 and 560 mg/kg. Some occupational epidenuiology research suggests an increased cancer risk associated with human exposure to chlordane. Chronic oral treatment with chlordane resulted in significant increases in hepatocellular carcinomas in mice. The EPA has classified chlordane as belonging to Group B2 probable human carcinogens.

Chlorobenzene: Chlorobenzene is a colorless liquid with a mild aromatic odor. It is used in the manufacture of aniline, phenol, and chloronitrobenzene and as an intermediate in the manufacture of dyestuffs and many pesticides. Exposure to chlorobenzene can occur through inhalation, ingestion, eye and skin contact. Direct contact exposure can lead to eye, nose and skin irritation. Long term exposure may cause liver damage. Chlorobenzene is not classifiable as to carcinogenicity.

2-Chlorophenol: 2-Chlorophenol exists as a light amber liquid. It is used as an intermediate in the manufacture of dyestuffs, higher chlorophenol, and preservatives. 2-Chlorophenol is toxic by all routes (i.e., ingestion, inhalation, dermal contact). Effects from exposure include burns to the skin and eyes, weakness, headache, dizziness, damage to the lung, liver, and kidneys, and death from cardiac or pulmonary failure. Ingestion caused increase then decrease of respiration; blood pressure; urinary output; fever; increased bowel action, motor weakness; collapse with convulsions and death. Ingestion causes lung, liver, kidney damage and contact dermatitis. Acute exposures by all routes may cause muscular weakness, gastroenteric disturbances, severe depression and collapse. Although effects are primarily on the central nervous system, edema of the lung and injury of pancreas and spleen also may occur. Oral exposure may produce rapid circulatory collapse and death. Chronic poisoning from oral or percutaneous absorption may produce digestive disturbances, nervous disorders with faintness, vertigo, mental changes, skin eruptions, jaundice, oliguria, and uremia. 2-Chlorophenol has been shown to increase conception rate, decrease litter sizes of exposed rats and to increase the percent of stillborn pups.

Cresols: Three types of closely related cresol exist: ortho-cresol (o-cresol), meta-cresol (m- cresol), and para-cresol (p-cresol). Pure cresol are colorless chemicals, but they may be found in brown mixtures such as creosote and cresylic acids (e.g., wood preservatives). Cresol in air quickly change and break down into smaller chemicals, some of which irritate the eyes. If you were to eat food or drink water contaminated with very high levels of cresol, you might feel a burning in the mouth and throat as well as stomach pains. If your skin were in contact with a substance containing high cresol levels, you might develop a rash or severe irritation. In some cases, a severe chemical burn might result. If you came into contact with high enough levels of cresol, for example, by drinking or spilling on your skin a substance containing large amounts of cresol, you might become anemic, experience kidney problems, become unconscious, or even die. Studies in animals have not found any additional effects that would occur after long-term exposure to lower levels of cresol. It is possible that some of the effects humans listed above, such as kidney problems and anemia, might occur at lower levels if exposure occurs over a longer time period. Effects on the nervous system, such as loss of coordination and twitching of muscles, are produced by low levels of cresol in animals, but we do not know whether low levels also cause such effects in humans. Cresol may enhance the ability of carcinogenic chemicals to produce tumors in animals, and they have some ability to interact with mammalian genetic material in the test tube, but they have not been shown to produce cancer in humans or animals. The EPA has determined that cresol are possible human carcinogens. Animal studies suggest that cresol probably would not produce birth defects or affect reproduction in humans.

1,2-Dichloroethane (1,2-DCA): The lungs, heart, liver, and kidneys are the organs primarily affected in both humans and animals exposed to 1,2-DCA. Short-term exposure to 1,2-DCA in air may result in an increased susceptibility to infection and liver, kidney, and/or blood

disorders. Effects seen in animals after long-term exposure to 1,2-DCA included liver, kidney, and/or heart disease, and death. 1,2-DCA has caused increased numbers of tumors in laboratory animals when administered in high doses in the diet or on the skin, and is classified as a Group B2 probable human carcinogen.

2,4-Dichlorophenol: 2,4-Dichlorophenol is a white solid, the form in which it is usually sold and used. 2,4-Dichlorophenol evaporates slightly faster than water, which evaporates slowly. It can also burn. Most of the 2,4-dichlorophenol made is used directly to make other chemicals, especially chemicals that kill weeds and other plants. 2,4-dichlorophenol also is used to kill germs. Reports describing possible 2,4-dichlorophenol poisoning of factory workers suggest that if you breathe air containing 2,4-dichlorophenol for several years, you may damage your liver, skin, and possibly your kidneys. Skin contact with it over a long period may cause the same effects. Animals that have eaten large amounts of 2,4-dichloropbenol in food immediately developed rapid breathing, muscle tremors, convulsions, weakness, hunched posture, loss of consciousness, and some even died. Animals that took small amounts of it in food or water over a long period of time had damaged livers, kidneys, spleens, bone marrow, and may also have damaged their respiratory tracts (although this may have been from breathing in the chemical rather than from swallowing it). Rats that drank water containing 2,4-dichlorophenol had some changes in the immune system, but the effects of 2,4-dichlorophenol on the immune system have not been fully studied. It is not known whether the same effects would happen in people if they were exposed in the same way. Some pregnant animals that drank water containing high levels of 2,4-dichlorophenol died, and those that drank enough to become sick had spontaneous abortions or gave birth to offspring that had low birth weights. Therefore, pregnant women who unknowingly eat or drink 2,4-dichlorophenol could harm themselves and their unborn babies. The EPA has not classified 2,4-dichlorophenol as a carcinogen.

Hexachlorocyclohexane (HCH): Hexachlorocyclohexane (HCH), formerly known as benzene hexachloride (BHC) and other common names, is a synthetic chemical that exists in eight chemical forms (called isomers). One of these forms, gamma-HCH (or Y-HCK commonly known as lindane), was once used as an insecticide on fruit, vegetable, and forest crops. It is still used in the United States and in other countries as a human medicine to treat head and body lice and scabies, a contagious skin disease caused by mites. It is a white solid that may evaporate into the air. The effects of breathing gramma-HCH and/or alpha-, beta-, and delta-HCH seen in humans are blood disorders, dizziness, headaches, and changes in the levels of sex hormones. These effects have occurred in workers exposed to HCH vapors during pesticide manufacture. People who have swallowed large amounts have had seizures and even died. A few people who have used very large amounts of garnma-HCH on their skin have had blood disorders or even seizures. Animals that have been fed gamma- and alpha-HCH have had convulsions, and animals fed beta-HCH have become comatose. All isomers can produce liver and kidney disease. Reduced ability to fight-infection was reported in animals fed gamma-HCK and injury to the ovaries and testes was reported in animals fed gamma-HCH or beta-HCH. In animals, exposure by mouth to gamma HCH during pregnancy may cause an increased number of fetuses with extra ribs. HCH isomers are changed by the body into other chemical products, some of which may be responsible for the harmful effects. Long-term oral administration of alpha-HCK beta HCH, gamma-HCK or technical-grade HCH to laboratory rodents has been reported to result in liver cancer. The EPA has classified HCH as a Group B2 probable human carcinogen.

Manganese: Following inhalation of manganese dust, absorption into the bloodstream occurs only if particles are sufficiently small to penetrate deeply into the lungs. Long-term inhalation of manganese dust may result in a neurological disorder characterized by imitability, difficulty in walking, and speech disturbances. Short-term inhalation exposure has been associated with respiratory disease. There are few reports of negative health effects in humans exposed to manganese in drinking water or food. Laboratory studies of animals exposed to manganese in water or food have demonstrated adverse health effects including changes in brain

chemical levels, low birth weights in rats when mothers were exposed during pregnancy, slower than usual testes development, decreased body weight gain, and weakness and muscle rigidity in monkeys. There are no human carcinogenicity data for manganese exposure. The data from some animal studies have shown increases in tumors in a small number of animals at high doses of manganese, but the data are inadequate to judge whether manganese can cause cancer. EPA has judged manganese not classifiable as to human carcinogenicity (Group D).

Mercury: Human exposure to inorganic mercury is mainly through inhalation or ingestion. Most dietary iorganic mercurials dissociate to divalent mercury in the gastrointestinal tract and are poorly absorbed. Occupational studies have demonstrated that chronic exposure to metallic mercury vapor via inhalation primarily affects the central nervous system and the kidneys. Human exposure to organic (usually methyl) mercury is mainly through ingestion. Methyl mercury compounds are known to be toxic via oral exposure, and fetuses and newborn infants are particularly susceptible. Subchronic methyl mercury poisoning occurred in humans eating contaminated fish from Minamata Bay, Japan, from 1953 to the 1960's. The medial level of total mercury in fish in Minamata Bay was estimated to be about 11 mg/kg fresh weight. Methyl mercury poisoning also occurred from eating bread produced from seed grain dressed with methyl mercury fungicide. Nerve damage causing "pins and needles" sensations in the hands and feet occurred at an estimated body burden of 25 mg of methyl mercury. No confirmed positive reports of methyl mercury carcinogenicity in humans has appeared to date, and animal experiments have generally yielded negative results.

Polycyclic Aromatic Hydrocarbons ("PAHs"): PAHs are a group of chemicals that are formed by the incomplete burning of coal, oil, gas, garbage, tobacco, or almost any other organic substance. Natural sources include forest fires and volcanoes. Consequently, PAHs occur naturally throughout the environment in the soil and other environmental media. Reproductive effects have occurred in animals that were fed certain PAHs. Long-term ingestion of PAHs in food has resulted in adverse effects on the liver and blood in mice. Those effects may also occur in humans, but there is no exposure data to substantiate that adverse impacts in humans have, in fact, occurred. No information is available from human studies to determine what non-cancerous adverse health effects, if any, may result from exposure to specific levels of the individual. PAHs, although inhalation and skin exposures to mixtures containing PAHs have been associated with cancer in humans. The levels and lengths of exposure to the individual PAHs that affect human health cannot be determined from the human studies available. Therefore, evaluation of non-cancer adverse health effects that may result from exposure is somewhat uncertain. EPA classifies a small group of PAHs as B2 probable human carcinogens. Benzo(a)pyrene is the most potent of the carcinogenic PAHs. Serveral PAHs have caused cancer in laboratory animals through ingestion, skin contact, and inhalation. Reports from human studies show that individuals exposed to mixtures of other compounds and PAHs by breathing or through skin contact for a long period of time can also develop cancer.

Polychlorinated Biphenyls ("PCBs"): PCBs can enter the body when fish, other foods, or water containmg PCBs are ingested, when air that contains PCBs is breathed, or when skin comes in contact with PCBs. Skin irritations characterized by acne-like lesions and rashes and liver effects were the only significant adverse health effects reported in PCB-exposed workers. Epidemiological studies of workers occupationally exposed to PCBs thus far have not found any conclusive evidence of an increased incidence of cancer in these groups. Effects of PCBs in experimentally exposed animals include liver damage, skin irritations, death, low birth weights, and other reproductive effects. Some strains of rats and mice that were fed PCB mixtures throughout their lives showed increased incidence of cancer of the liver and other organs. Based on these animal studies, the EPA has classified PCBs as Group B2 probable human carcinogens.

1,1,2-Trichloroethane (1,1,2-TCA): No case reports or epidemiological studies regarding human occupational or environmental exposure are available. Studies with various animals,

however, suggest that 1,1,2-TCA can enter the body following inhalation of contaminated air, ingestion of or dermal contact with contaminated drinking water, or through dermal contact with the solvent itself 1,1,2-TCA is a central nervous system depressant. It has narcotic properties and can act as a local irritant to the eyes, nose, and lungs. Chronic exposure to 1,1,2-TCA is also associated with both liver and kidney damage. It caused liver tumors in mice, but not rats. No other studies have shown evidence of carcinogenicity, however. Further studies with rats using higher concentrations, and other species would improve the knowledge of 1,1,2-TCA carcinogenicity. Based upon the present evidence from animal studies, the EPA considers 1,1,2-TCA a Group C possible human carcinogen.

Trichloroethylene: Trichloroethylene is a colorless, nonflammable, noncorrosive liquid primarily used as a solvent in vapor degreasing. It is also used as a dry-cleaning agent, and as a chemical intermediate in the production of paints and varnishes and other chemicals. Trichloroethylene has low acute toxicity. Chronic inhalation exposure to trichloroethylene has been shown to cause liver, kidney, and nervous system disorders and skin irritation in animals. The EPA has classified trichloroethylene as a Group B2-C carcinogen.

2,4,6-Trichlorophenol: 2,4,6-Trichlorophenol appears as a yellow solid. It has a strong, sweet smell and does not burn easily. It does not occur naturally, In the past, the major uses of 2,4,6-trichlorophenol were as an antiseptic and pesticide. Its uses also included preserving wood, leather and glue, and preventing the buildup of mildew on fabric. In the environment, 2,4,6-trichlorophenol is found most frequently in water, especially near hazardous waste sites contaminated with 2,4,6-trichlorophenol. 2,4,6-Trichlorophenol can evaporate into the air. The human health effects of 2,4,6-trichlorophenol are not known. However, it is possible that health effects observed in animals following exposure to 2,4,6-trichlorophenol could occur in humans. No information was found on short-term animal studies. However, results of long- term animal studies show that 2,4,6-trichlorophenol causes changes in liver and spleen cells, and lowers body weight. Long-term exposure to high levels of 2,4,6-trichlorophenol causes death in some animals. This suggests that high levels of 2,4,6-trichlorophenol may be life-threatening to humans. Cancer occurs in animals after continued long-term oral exposure to 2,4,6-trichlorophenol. Whether or not 2,4,6-trichlorophenol causes cancer in humans has not been adequately studied. However, because 2,4,6-trichlorophenol causes cancer in animals, it is possible that 2,4,6-trichlorophenol could cause cancer in humans. The EPA has classified 2,4,6-trichlorophenol as a Group B2 probable human carcinogen. 2,4,6-Trichlorophenol has not been studied to determine if it causes birth defects, but 2,4,6-trichlorophenol has been shown in animals to cause lowered body weight in newborns and a decrease in the number of offspring. The higher the level of exposure and the longer the exposure to 2,4,6-trichlorophenol, the greater the chance for adverse health effects.

5. Risk Characterization

The risk characterization process integrates the toxicity and exposure assessments into a quantitative expression of risk. For carcinogens, the exposure point concentrations and exposure factors discussed earlier are mathematically combined to generate a chronic daily intake value that is averaged over a lifetime (i.e., 70 years). This intake value is then multiplied by the toxicity value for the contaminant (i.e., the slope factor) to generate the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the contaminant. The National Oil and Hazardous Substances Pollution Contingency Plan ("NCP") established acceptable levels of carcinogenic risk for Superfund sites ranging from one excess cancer case per 10,000 people exposed to one excess cancer case per one million people exposed. Expressed as scientific notation, this risk range is between 1.0E-04 and 1.0E-06. Remedial action is warranted at a site when the calculated cancer risk level exceeds 1.0E-04. However, since EPA's cleanup goal is generally to reduce the risk to 1.0E-06 or less, EPA also may take action where the risk is within the range between 1.0E-04 and 1.0E-06.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (i.e., the chronic daily intake) with the toxicity of the contaminant for a similar time period (i.e., the reference dose). The ratio of exposure to toxicity is called a hazard quotient. A Hazard Index ("HI") is generated by adding the appropriate hazard quotients for contaminants to which a given population may reasonably be exposed. The NCP also states that sites should not pose a health threat due to a non-carcinogenic, but otherwise hazardous, chemical. If the HI exceeds one (1.0), there may be concern for the potential non-carcinogenic health effects associated with exposure to the chemicals. The HI identifies the potential for the most sensitive individuals to be adversely affected by the noncarcinogenic effects of chemicals. As a rule, the greater the value of the HI above 1.0, the greater the level of concern.

Table 9 summarizes the total risk levels from all appropriate exposure routes calculated for each group of individuals.

B. Ecological Risk Assessment

NLC and EPA collectively evaluated the ecological risks associated with the Site. Based on these evaluations, contamination in all media (i.e., surface water, sediment, soil, and groundwater) have the potential to have significant adverse impacts on the aquatic ecosystem of the river. In surface water, concentrations of mercury, copper, and chromium (VI) are potentially harmful to the Main Channel of the Ohio River while chromium and copper present an ecological risk in the Back Channel. Contaminants of ecological significance in the sediment adjacent to the Site in both the Main Channel and the Back Channel include heavy metals, pesticides, PCBs, and SVOCs, particularly phenols. In soil at the Site, metal contaminants including arsenic, copper, lead, manganese, mercury and zinc are present at levels that have a high potential to affect ecological receptors. Other soil contaminants, mostly PAHs and pesticides, were found above background levels and could also result in adverse impacts. Groundwater, which is a pathway by which soil contaminants reach the river, is contaminated by several contaminants of ecological concern, particularly mercury, zinc, phenols and phthalates. Pesticides and chlorocarbons are also of concern. Given the level of contamination in surface water and sediment, soil contaminants from the Site are suspected to have contributed to degradation of the river.

Table 9 - Human Health Risks at the Site

Group of Individuals	Cancer Risk	Hazard Index
On-Site Residents consuming groundwater	4.54E-02	10,000
On-Site Residents on public water supply	3.00E-04	26.3
Off-Site Residents consuming groundwater from the Site	2.24E-04	1,710
Off-Site Residents consuming river water that came from the Site	1.86E-04	25.3
Recreational Site Users	1.85E-04	25.0
On-Site Workers consuming groundwater	1.48E-02	732
On-Site Workers on public water supply	1.45E-05	0.0234
Trespassers	3.35E-06	0.0294

VIII. DESCRIPTION OF ALTERNATIVES

In the Feasibility Study ("FS"), engineering technologies that can be used to control the contamination at the Site were screened according to their effectiveness and implementability. Those technologies remaining after the screening process were then developed into remedial alternatives. The alternatives in the FS address the following media: soil, groundwater, surface water, and sediment. This Record of Decision focuses exclusively on groundwater; therefore, only the FS alternatives dealing with groundwater are presented below.

Alternative 1: No Action

Present Worth Cost: $0
Time to Implement: 0

The NCP requires that EPA consider a "No Action" alternative for every Superfund site to establish a baseline or reference point against which each of the remedial action alternatives are compared. In the event that the other identified alternatives do not offer substantial benefits the reduction of toxicity, mobility, or volume of the constituents of concern, the No Action alternative may be considered a feasible approach. This alternative leaves the Site undisturbed and all current and potential future risks would remain.

Alternative 2: Groundwater Extraction and Treatment, Long-Term Monitoring, and Institutional Controls

Total Present Worth Cost: $9,990,000
Time to Implement: 30 years

A groundwater extraction and treatment system would be designed and installed to contain the contaminated groundwater at the Site and prevent off-site migration of contamination. The groundwater extraction system would consist of five deep groundwater extraction wells, operating with a total flow rate of 200 gallons per minute ("gpm"). The location of the extraction system and wells would be determined during the remedial design. The groundwater treatment system would include a metal precipitation unit to extract high concentrations of inorganic contanunants followed by a 200 gpm air stripping system to remove the volatile organic contaminants. Before being discharged to the Ohio River, the air stripper effluent would be passed through an activated carbon bed to remove the residual organic contaminants, as well as pesticides and herbicides. The system would be designed to achieve State surface water discharge requirements. Groundwater extraction and treatment would continue at the Site until benzene and 2,4,6-TCP concentrations meet their MCLs for 12 consecutive quarters throughout the area of attainment. The area of attainment encompasses the groundwater monitoring points located along the property line on the shoreline. When the MCLs are met, the pump-and-treat operation would be suspended and a long-term monitoring program would be implemented. If MCLs are again exceeded within the area of attainment, groundwater extraction and treatment would be resumed until MCLs are achieved for 12 consecutive quarters throughoufthe area of containment. The long-term monitoring program would then resume. If MCLs are met consistently for a period of five years, the extraction and treatment system could be permanently dismantled; however, monitoring would continue.

A long-term monitoring program would be required to assess the effectiveness of the groundwater extraction and treatment system in controlling off-site migration of contaminated groundwater. The overall duration of the monitoring period is 30 years. This monitoring program would consist of quarterly sampling for three years. The sampling frequency may be reduced for some or all of the monitoring wells to semiannual or annual based on the data from the first three years of sampling. A statistical analysis would be performed on the initial 12

quarters of data to determine the appropriate monitoring frequency. The statistical approach would be determined during the Remedial Design. Although the exact location and number of groundwater monitoring points would be determined in the Remedial Design, the following number and general locations were used for cost-estimating purposes:

- Eight on-site monitoring points located along the property fine on the Back Channel side of the island;
- Three off-site monitoring points located beneath the Back Channel to monitor the downgradient edge of the benzene plume;
- One off-site monitoring point located beneath the Main Channel; and

- the Coraopolis sentinel well.

The analytical requirements include:

- Monitor the on-site wells and the Coraopolis sentinel well for SVOCs, VOCs, metals, and natural attenuation parameters (i.e., specific conductivity, redox potential, dissolved oxygen, ferrous iron); and
- Monitor the off-site wells for benzene, 2,4,6-trichlorophenol, sulfate, iron II, manganese II and redox-potential.

Water level measurements would also be required to evaluate the hydraulic performance of the extraction system.

Institutional controls would be implemented to restrict land and groundwater use at the Site and reduce the potential for human exposure to contamination. Deed restrictions would be required to eliminate the future possibility of residential development and/or use of groundwater at the Site. Warning signs would be posted along the banks of the island to warn fishermen against eating fish. These signs would be properly maintained as long as the fish in the Ohio River are found to have high levels of contaminants that can cause adverse human health effects, The exact wording of these signs would be agreed upon during the Remedial Design by EPA, in consultation with PADEP.

Alternative 3: Monitored Natural Attenuation and Institutional Controls

Total Present Worth Cost: $1,010,000
Time to Implement: 30 years

This alternative includes the long-term monitoring program and institutional controls described above in Alternative 2. If the natural attenuation processes continue to reduce the plume with no evidence of migration of benzene or 2,4,6-trichlorophenol during the first three years of the long-term monitoring program, EPA may reduce the sampling frequency thereafter to semi-annual or annual and the analytical requirements to the following:

- on-site wells for benzene, 2,4,6-trichlorophenol, sulfate, iron II, manganese II, and redox potential;
- off-site wells for benzene, 2,4,6-trichlorophenol, specific conductivity, redox potential, dissolved oxygen, ferrous iron; and
- the Coraopolis sentinel well for VOCs and metals.

If the analytical data from the two consecutive monitoring events indicates that the plume has expanded and contaminants are migrating off-site at levels that pose an unacceptable risk to human health or the environment, or that the natural attenuation processes are not protecting human health and the environment, a contingency measure including the installation of the

groundwater extraction and treatment system described in Alternative 2 would be implemented.

The goal of the remediation process is to achieve MCLs in the groundwater at the shoreline within 30 years. At any time during the remediation process, the determination that MCLs have been achieved would be based on a statistical evaluation of groundwater data collected for three consecutive years.

VIII. COMPARATIVE EVALUATION OF ALTERNATIVES

Each of the three remedial alternatives summarized above has been evaluated with respect to the nine (9) evaluation criteria set forth in the NCP, 40 C.F.R. Section 300.430(e)(9). These nine criteria can be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. A description of the evaluation criteria is presented below:

Threshold Criteria:

1. Overall Protection of Human Health and the Environment addresses whether a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled.
2. Compliance with Applicable or Relevant and Appropriate Requirements ("ARARs") addresses whether a remedy will meet all of the applicable, or relevant and appropriate requirements of environmental statutes.

Primary Balancing Criteria:

3. Long-term Effectiveness refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals are achieved.
4. Reduction o Toxicity, Mobility, or Volume through Treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume of contaminants.
5. Short-term Effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and environment that may be posed during the construction and implementation period until cleanup goals are achieved.
6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
7. Cost includes estimated capital, operation and maintenance, and present worth costs.

Modifying Criteria:

8. State Acceptance indicates whether, based on its review of backup documents and the Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.
9. Community Acceptance is assessed in the Record of Decision following a review of public comments received on the Proposed Plan and supporting documents included in the Administrative Record. Significant public comments received, and responses to those comments, are included in the Responsiveness Summary in Part III of this ROD.

A. Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial alternative be protective of human health and the environment. A remedy is protective if it reduces current and potential risks to acceptable levels under the established risk range for each exposure pathway at the

Site.

The remedy selected previously in the Record of Decision ("ROD") for OU-1 reduces the current and potential risks associated with the buried waste and contaminated soil at the Site by requiring the construction of either a multilayer cap or an erosion cap over the contaminated areas. The multilayer cap will prevent rain water from coming in contact with the buried waste and reduce the migration of contanimants to the groundwater. The OU-1 ROD requires groundwater monitoring to evaluate the effectiveness of the multilayer cap in controlling the source of the contamination.

Alternatives 2 and 3 in this ROD will both reduce the potential risks associated with use of contaminated, groundwater at the Site and are protective of human health and the environment. Both alternatives will immediately reduce the potential for exposure to the contaminated groundwater by requiring institutional controls to prevent use of the groundwater at the Site. These alternatives further protect human health and the environment by reducing the contaminant levels in the groundwater over time. Alternative 2 does so through an active extraction and treatment system while Alternative 3 relies on natural attenuation processes to achieve acceptable levels. Alternative 3 requires implementation of an active extraction and treatment system if the monitoring demonstrates that natural attenuation cannot achieve the acceptable cleanup levels. Both alternatives require monitoring of the groundwater to ensure that acceptable contaminant levels are achieved.

Alternative 1 (No Action) is not protective of human health and the environment because this alternative does not require institutional controls to prevent the possibility of exposure to the contaminated groundwater and does not require groundwater monitoring to ensure that the contamination is reduced to acceptable levels. Because this alternative does not meet the threshold criteria of protection of human health and the environment, it will not be considered further in this analysis.

B. Compliance with Applicable or Relevant and Appropriate Requirements ("ARARS") 1

[1 Under Section 121(d) of CERCLA, 42 U.S.C. º 9621(d), and EPA guidance, remedial actions at CERCLA sites must attain legally applicable or relevant and appropriate federal and promulgated state environmental standards, requirements, criteria and limitations which are collectively reffered to as "ARARs, "unless such ARARs are waived under Section 121(d)(4) of CERCLA, 42 U.S.C. º 9621(d)(4).]

Any cleanup alternative considered by EPA must comply with all applicable or relevant and appropriate federal and state environmental requirements. Applicable requirements are those substantive environmental standards, requirements, criteria, or limitations promulgated under federal or state law that are legally applicable to the remedial action to be implemented at the Site. Relevant and appropriate requirements, while not being directly applicable, address problems or situations sufficiently similar to those encountered at the Site that their use is well-suited to the particular site.

Alternatives 2 and 3 would comply with the following ARARs, as appropriate:

Chemical-Specific ARARs

Groundwater Under the Safe Drinking Water Act, 42 U.S.C. ºº 300 f to 300 j-26, and its implementing regulations, 40 C.F.R. Part 141, MCLs are established for acceptable concentrations of contaminants in public drinking water supplies. EPA considers the MCLs for benzene, tetrachloroethane, 1,1,1-trichloroethane, toluene, xylenes (Table 1) and Secondary MCLs for aluminum, cadmium, copper, iron, silver, zinc (Table 3) to be relevant and appropriate

requirements for groundwater at the Site. The goal of Alternatives 2 and 3 is to achieve these MCLs at the property line. The long-term monitoring program for Alternatives 2 and 3 will also include monitoring the Coraopolis public water supply to ensure that contaminated groundwater from the Site does not impact the water supply.

Under the Land Recycling and Environmental Remediation Standards Act of Pennsylvania, (Act 2), Medium-Specific Concentrations ("MSCs") for contaminants in groundwater are established at 25 Pa.Code Chapter 250, Section 250.304. For any contaminants of concern for which an MCL does not exist, the MSC would be applicable.

Surface Water: Water quality standards have been established for acceptable concentrations of contaminants in Commonwealth waters and are set forth in 25 Pa. Code Chapter 93. In addition, water quality criteria fore toxic substances are set forth in 25 Pa Code Chapter 16. The long-term monitoring program for Alternatives 2 and 3 will include monitoring to ensure that the river is not adversely impacted by migration of contaminants from the Site. On-site extraction and treatment of groundwater under Alternative 2 and monitored natural attenuation under Alternative 3 will reduce migration of contaminants to levels that achieve water quality standards and water quality criteria for toxic substances.

Action-Specific ARARs

Discharge of Treated Groundwater The groundwater extraction and treatment component of Alternative 2 involves discharging treated water from the groundwater treatment system into surface water, namely the Ohio River. The more stringent of the substantive requirements of the Clean Water Act and the Pennsylvania Clean Streams Law regarding discharges to surface waters would be applicable to such discharges, including 40 C.F.R. Part 122 (National Pollutant Discharge Elimination System), 40 C.F.R. Part 131 (Water Quality Standards), 25 Pa. Code Chapter 92 (NPDES: regarding establishment of discharge limits and monitoring) and 25 Pa. Code Chapters 16 and 93 (Water Quality Standards: regarding water quality criteria which must be used in the development of the discharge limits).

Groundwater Storage: Temporary storage requirements set forth in 25 Pa. Code Sections 129.56-57 are relevant and appropriate to the temporary storage of pumped groundwater prior to removal of VOCs by the air stripper under Alternative 2.

Hazardous Waste Generation: Alternative 2 may result in the generation of wastes that would be regulated under current hazardous waste regulations. Any hazardous waste generated must be handled consistent with the requirements of 25 Pa. Code Chapter 262 Subchapter A (relating to hazardous waste determination and identification numbers), and 25 Pa. Code Chapter 264 subparts G, I and J (relating to storage of generated hazardous wastes in containers or tanks).

C. Reduction of Toxicity, Mobility, or Volume through Treatment

Section 121(b) of CERCLA, 42 U.S.C. Section 9621(b), establishes a preference for remedial actions which include treatment that permanently and significantly reduces the toxicity, mobility, or volume of contaminants, Alternative 2 requires groundwater extraction and treatment to reduce die toxicity, mobility and volume of contaminants at the Site. Alternative 3 relies on natural attenuation processes to reduce the toxicity, mobility and volume of contaminants in groundwater at the Site. Both alternatives are expected to require approximately 30 years to reduce concentrations to acceptable levels.

D. Implementability

This evaluation criterion addresses the difficulties and unknowns associated with

implementing the cleanup technologies associated with each alternative, including the ability and time necessary to obtain required permits and approvals, the availability of services and materials, and the reliability and effectiveness of monitoring. The groundwater extraction and treatment technologies required under Alternative 2 are readily available; however, the hydrogeologic conditions at the Site may make it difficult to effectively contain the plume of groundwater contamination. The ability to pump water from the contaminated plume beneath Neville Island without pumping large volumes of water from the Ohio River is questionable. Additional studies to evaluate the ability to effectively extract groundwater at the Site would be performed during the remedial design. Alternative 3 can be readily implemented because this alternative relies an natural processes currently taking place at the Site to reduce the groundwater contamination to acceptable levels.

E. Short-Term Effectiveness

Alternative 2 may potentially pose some short-term risks to workers and/or trespassers during construction and operation of the extraction and treatment system and during monitoring activities at the Site. Alternative 3 would pose fewer short-term risks because construction and operation of an extraction and treatment system is not required. Short-term risks under either alternative would be low and can be readily minimized using standard safety measures.

F. Long-term Effectiveness and Permanence

Alternatives 2 and 3 provide a permanent and effective long-term remedy, EPA assumes that if groundwater from the contaminated plume can be pumped effectively at the Site, Alternative 2 would attain the MCL for benzene along the shoreline of Neville Island within 30 years. Alternative 2 has the potential to achieve the benzene MCL in less time than Alternative 3 by actively pumping and treating the groundwater assuming that groundwater from the contaminated plume can be effectively extracted.

To estimate the time required to attain the MCL for benzene under Alternative 3, the data collected during the RI and the OU3 study were used in three-dimensional fate and transport models to predict the rate of natural attenuation occurring at the Site. The modeling results indicated that the benzene concentrations may be reduced to the MCL of 5 ppb at the shoreline (i.e., the point of compliance) within approximately 15 years. The modeling further indicates that the benezene concentrations can achieve the MCL across the entire Site in approximately 60 years. Based on this modeling, EPA estimates that benzene levels will comply with the MCL at the shoreline in less than 30 years following capping of the wastes. The mobility of the plume will be reduced by implementing the OU-1 ROD. The multilayer cap will create an impermeable barrier to reduce the infiltration of surface water through the concentrated pockets of waste buried at the Site. The OU-1 ROD requires monitoring to ensure that migration of contaminants from the source areas to the groundwater is reduced. Alternative 3 in this ROD requires additional monitoring to ensure that natural attenuation process will effectively reduce the contaminant levels in the existing plume to acceptable levels. If the contaminant concentrations do not decrease and levels remain that pose an unacceptable risk to human health or the environment, active extraction and treatment of the groundwater would be required under Alternative 3.

G. Cost

The cost of each alternative includes the calculation of direct and indirect capital costs and the annual operation and maintenance ("O&M") costs, both calculated on a present worth basis. The total present worth cost of Alternatives 2 and 3 has been calculated for comparative purposes and is presented in Table 10. Alternative 2 is substantially more expensive than Alternative 3.

Direct capital costs include costs of construction, equipment, building and services, and waste disposal. Indirect capital costs include engineering expenses, start-up and shutdown, and contingency allowances. Annual O&M costs include labor and material; chemicals, energy, and fuel, administrative costs and purchased services; monitoring costs; costs for periodic Site reviews (every five years); and insurance, taxes, and license costs. For cost estimation purposes, a period of 30 years has been used for O&M.

The actual duration of operation for the groundwater extraction and treatment system will depend on the system's ability to successfully limit off-site migration of Site-related contaminants. The actual cost for each alternative is expected to be in a range from 50 percent (50%) higher than the costs estimated to 25 percent (25%) lower than the costs estimated. The evaluation was based on the FS cost estimates, as modified by EPA.

Table 10
Estimated Cost of Alternatives

Alternative	Total Present Worth Cost		
	Years 1 - 3	Years 4 - 30	Total
2	$1,700,000	$8,290,000	$9,990,000
3	$200,000	$810,000	$1,010,000

H. State Acceptance

PADEP has reviewed this Record of Decision and comments received from PADEP have been incorporated as appropriate. PADEP has provided support to EPA throughout the Superfund process at this Site. PADEP concurs with the remedy selected in this ROD.

I. Community Acceptance

EPA has considered the comments received during the public comment period on its preferred remedial alternative presented in the Proposed Plan. These comments are summarized and responses are provided in Part III (Responsiveness Summary) of this Record of Decision. In general, the community and NLC support the preferred alternative.

IX. SELECTED REMEDY AND PERFORMANCE STANDARDS

Based on a comparison of the nine evaluation criteria for the alternatives considered in this ROD, EPA has selected Alternative 3: Monitored Natural Attenuation and Institutional Controls to address OU-3 at the Site. Alternative 3 meets the threshold criteria of overall protection of human health and the environment and compliance with ARARs. In considering the balancing criteria, EPA believes Alternative 3 can be readily implemented, achieves long-term effectiveness and permanence at a reasonable cost, minimizes the short-term impacts, and effectively reduces the mobility of Site contaminants. The requirements for implementing Alternative 3 are as follows:

A. Natural Attenuation Requirements

1. Natural attenuation processes shall be allowed to reduce the concentrations of benzene and 2,4,6-trichlorophenol in the groundwater plume at the Site to levels that protect human health and the environment. EPA has determined that the appropriate cleanup levels for benzene and 2,4,6-trichlorophenol are 5.0 and 61 ppb, respectively. The cleanup level for benzene is based on the current Safe Drinking Water Act MCL for this contaminant. The cleanup level for 2,4,6-trichlorophenol is based on EPA Region III risk-based concentration for tap water presenting the cancer risk of 10 -5.

2. A statistical evaluation of the monitoring data shall be performed every three years, unless EPA determines that more frequent analysis is required, to determine the rate at which natural attenuation processes are reducing contaminant levels at this Site.

3. If EPA determines that (1) the natural attenuation processes are not reducing contaminant concentrations at a rate that will achieve the cleanup levels in a reasonable time period (approximately 30 years) and (2) the contaminant levels present pose an unacceptable risk to human health and the environment, construction and operation of a groundwater extraction and treatment system at the Site shall be required.

B. Monitoring Requirements

1. Monitoring shall be performed to measure changes in contaminant concentrations in the groundwater plume at the Site until the cleanup levels have been achieved. The exact location and number of groundwater monitoring points shall be determined by EPA during the Remedial Design process. Monitoring points shall be located along the property line on the Back Channel side of Neville Island, beneath the Back Channel at the downgradient edge of the benzene plume, beneath the Main Channel, and at the Coraopolis public water supply well nearest to the Site.

2. Samples shall be collected from the monitoring points on a quarterly basis. Samples from the monitoring points located on Neville Island and the Coraopolis public water supply well shall be analyzed for VOCs (Table 1), SVOCs (Table 2), metals (Table 3) and natural attenuation parameters including dissolved oxygen, nitrate, manganese II, iron II, sulfate, methane, redox potential/Eh, alkalinity, and pH. Monitoring points located beneath the Main and Back Channels shall be analyzed for, at a minimum, benzene, 2,4,6-trichlorophenol and the natural attenuation parameters.

3. If EPA determines that a statistical evaluation of the groundwater data collected for the first twelve quarters of the monitoring program demonstrates that natural attenuation processes are reducing the contaminant concentration at a reasonable rate and the contaminants are not migrating, EPA may reduce the frequency of sample collection and may limit the scope of analysis required. If EPA determines that contaminant levels are not decreasing at a reasonable rate or that contaminant migration is occurring, EPA may increase the frequency of sample collection and may require additional analysis.

C. Institutional Controls

1. Deed restrictions shall be placed on Site property to prohibit use of the groundwater until cleanup levels have been achieved.
2. Warning signs shall be posted along Site shoreline to warn fishermen not to eat fish caught in the area. These signs shall be properly maintained as long as fish in the Ohio River are found to have high levels of contaminants that can cause adverse human health effects. The wording of these signs shall be approved by EPA, in consultation with PADEP, during the Remedial Design.

X. STATUTORY DETERMINATIONS

This remedy satisfies the remedy selection requirements of CERCLA and the NCP. The remedy is expected to be protective of human health and the environment, complies with ARARs, is cost effective, and utilizes permanent solutions. The remedy does not include treatment as a principal element of the remedy because natural attenuation processes can reduce contaminant concentrations to levels that protect human health and the environment within a reasonable time frame. Additionally, once the remedy (the cap) for OU-1 is completed there will be no risk of direct exposure to the Site-related contaminants. The following is a discussion of how the selected remedial action addresses the statutory requirements.

A. Overall Protection of Human Health and the Environment

The selected remedy will provide adequate protection of human health and the environment by stabilizing the plume of contaminated groundwater beneath the multilayer/erosion cap. This action will reduce the carcinogenic risk from exposure to contaminated groundwater to commercial, industrial, and recreational Site users to within the acceptable EPA risk range of 10 -4 to 10 -6, and will reduce the Hazard Index to less than one for non-carcinogenic risks. This remedy will also minimize further migration of contaminated groundwater into surface water and sediment.

B. Compliance with Applicable or Relevant and Appropriate Requirements ("ARARS")

The selected remedy will comply with the Safe Drinking Water Act MCLs, and the Act 2 MSCs for any contaminant for which an MCL does not exist, and the Pennsylvania water quality standards and water quality criteria for toxic substances.

C. Cost Effectiveness

EPA has determined that the selected remedy most effectively addresses contaminated waste/soils while minimizing costs. The estimated present worth cost is $1,010,000. Other alternatives were either less expensive, but ineffective, or more expensive, but only marginally more protective than the selected remedy.

D. Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and alternative treatment technologies can be utilized in a cost-effective manner at the Site. The selected remedy does not require treatment because the treatment alternative considered (groundwater extraction and treatment) would achieve only marginal additional protection for ten times the cost.

E. Preference for Treatment as a Principal Element

As stated above, the selected remedy does not require treatment because the treatment alternative considered (groundwater extraction and treatment) would achieve only marginal additional protection for ten times the cost.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

This ROD did not change the preferred remedial alternative, Alternative 3, identified in the Proposed Plan to address groundwater contamination at the Site.

RECORD OF DECISION
OHIO RIVER PARK

PART III -RESPONSIVENESS SUMMARY

This responsiveness summary is divided into the following sections:

- D A section on background information that provides a brief history of community involvement;
- D A section on major issues and concerns that provides a summary of major concerns expressed by the local community during the public meeting and in several letters received by EPA during the public comment period;
- D A section on technical and legal issues that responds to specific comments pertaining to technical and legal issues, which were raised during the public comment period.

I. BACKGROUND

On February 25, 1998, EPA announced the public comment period and published its preferred alternative for Operable Unit 3 ("OU-3") of the Ohio River Park Site located on Neville Island in Allegheny County, Pennsylvania. To obtain public input on the Proposed Remedial Action Plan ("Proposed Plan") for OU-3, EPA held a public comment period from February 25, 1998, to March 26, 1998. EPA nofified the public of the March 17, 1998, public meeting and announced the public comment period in display ads placed in the February 25 and March 11 editions of the Pittsburgh Tribune Review, the Coraopolis Record and the Pittsburgh Post-Gazette. In addition, EPA has established a Site information repository at the Coraopolis Memorial Library. The repository contains the Proposed Plan, the Remedial Investigation, the Baseline Risk Assessment, the Ecological Risk Assessment, the Feasibility Study, the Intrinsic Remediation Demonstration Study, and other relevant documents. EPA's Administrative Record for the Site, which includes the key documents the Agency used in selecting the Site remedy, also is housed at the repository. EPA also prepared a Site fact sheet and distributed it to individuals on the Site mailing list and in attendance at the public meeting. The fact sheet included a summary of the Proposed Plan.

Those in attendance at the meeting included local area residents; state, county, and local officials; news media representatives, representatives from EPA; and representatives from companies interested in the Site activities and cleanup decisions. EPA briefed local officials prior to the public meeting. EPA carefully considered state and community acceptance of the remedy prior to reaching the final decision regarding the remedy.

II. MAJOR ISSUES AND CONCERNS

A. OU-1 Remedial Action

1. A resident asked whether any tests to detect radioactive material had ever been performed at the Site and inquired whether the cap was selected in response to radioactive contamination.

Response: No historical records were identified that indicate radioactive material was disposed of at the Site. As a standard protocol, however, EPA contractors perform radiation surveys as part of their health and safety monitoring when conducting investigation activities at hazardous waste sites. The cap was not selected to address radioactive contamination. The cap was selected to (1) stop surface water from infiltrating the contaminated soil below, and (2) prevent direct contact with the contaminated soil.

2. Another resident wrote a letter stating that in 1979, when the construction for the original park started, his family became sick from the fumes released during soil excavation at the Site. The resident expressed concern that the current construction may release fumes and make his family sick again.

Response: The contaminated soil and debris will not be excavated as part of the OU-1 remedial action. Instead, a cap will be placed over the contaminated soil and debris to prevent any direct contact with the contaminated soil at the Site. During cap installation and other onsite construction projects, the ambient air will be monitored to ensure that contaminants are not being released. Best management practices for dust suppression will also be implemented at the Site.

3. A resident asked of what type of material the cap is made.

Response: The final design of the multilayer cap has not been submitted to EPA for approval. However, the cap will consist of a RCRA cap overlain by an erosion control cover. RCRA caps are typically constructed with multilayered geotextiles or clay soil. Erosion control covers are made of approximately three feet of clean soil.

4. A resident asked how long it would take to install the cap.

Response: Neville Land Company plans to begin construction of the cap during the summer of 1999. The cap remedial design documents were approved on September 8, 1998, and the cap may be completed by October/November 1998.

5. A resident expressed concern about whether the multilayer cap was designed to withstand the floods that occur on Neville Island.

Response: Neville Land Company designed the cap and the erosion control devices to withstand a 100-year flood event.

6. One resident asked whether the existing oil derrick is a significant source of contamination at the Site.

Response: There is no evidence from past sampling activities that the existing oil derrick is contributing to Site contamination, Neville Land Company is currently in the process of closing the oil derrick. This will be accomplished in accordance with all applicable local, state, and Federal regulations.

7. Several residents expressed concern over EPA's decision not to remove all the contaminated soil and debris from the Site.

Response: A variety of factors were considered and investigated during the remedial investigation phase of the project. The most important consideration is to protect human health and the environment from the Site contamination. The capping alternative protects human health and the environment by preventing exposure to the buried wastes and contaminated soil. Since this alternative is protective, EPA weighed the criteria to determine which alternative was the best overall solution for the Site. EPA analysis of these criteria are included in the Record of Decision issued for OU-1. Excavating and removing the contaminated material would cost approximately 40 million dollars compared to approximately 8 million dollars for capping and monitoring. In addition, excavating and removing the contaminated soil from the Site could potentially expose Site workers, surrounding residents and the environment to the Site contaminants.

B. Natural Attenuation

1. Several residents asked what happens to the contaminated material in the groundwater during the natural attenuation process.

Response: Natural attenuation is defined as naturally occurring processes in soil and groundwater that act, without human intervention, to reduce the mass, toxicity, mobility, volume, or concentration of contaminants present. In other words, the contaminated material in the groundwater will degrade naturally over time. Studies performed by Neville Land Company, and reviewed by EPA and the State, demonstrated that natural attenuation is occurring in the groundwater at the Site.

2. A resident asked whether the cap would prevent any degradation of the contaminated soil beneath it by not allowing any surface water to percolate through the contaminated material.

Response: The cap may affect the rate at which the contaminants degrade. However, the cap will prevent direct human contact with the contaminated soil and will eliminate the source of groundwater contamination by preventing rain water from percolating through the contaminated soil.

3. A resident asked why dissolved oxygen levels in the groundwater are higher offsite than onsite.

Response: The dissolved oxygen values are not contamination values. The dissolved oxygen values indicate that natural attenuation is occurring. The values onsite are lower because the reactions that degrade the contaminants utilize the available dissolved oxygen in the groundwater. The higher dissolved oxygen levels detected offsite represent naturally occurring or background levels of dissolved oxygen in the groundwater.

C. Risk Evaluation

1 A resident asked why the Site is being cleaned up if, through natural attenuation, it will clean itself in 30 years.

Response: Natural attenuation will only be able to reduce the contaminant levels in the groundwater over time if no additional contamination is allowed to reach the aquifer. The multilayer cap is needed at the Site to prevent further migration of contaminants that remain in the buried waste and contaminated soil. Institutional controls are also needed to ensure that the Site is not used improperly for residential development and that use of the groundwater is prohibited. Finally, a monitoring program is necessary to ensure that natural attenuation actually occurs in the manner predicted.

2. Several residents were concerned about the cancer risk posed by the contaminated material at the Site and asked if a study had been performed to determine if there was a higher incidence of cancer to residents living near the Site.

Response: No cancer study has been performed for the Site. However, a Baseline Human Health Risk Assessment was conducted as part of the remedial investigation to determine the cancer and noncancer risks posed to current and future users of the Site in the absence of Site remediation. The Baseline Human Health Risk Assessment evaluated contaminated soil, sediment, groundwater, and surface water exposure routes. Results showed that without the comtruction of a cap, the cancer risk levels exceeded the acceptable levels specified in the National Oil and Hazardous Substances Pollution Contingency Plan. However, the actions required by the OU-1

Record of Decision and those required in this Record of Decision will reduce the cancer risk levels associated with the Site to acceptable levels for daily recreational Site users, workers, and trespassers.

3. Another resident agreed with EPA that the preferred alternative, Alternative 3, is appropriate to clean up the Site, but felt that the Site is not the best place for a recreational facility because of the risk of being exposed to Site contamination.

Response: After the cap, erosion cover, and institutional controls are in place, the risk to human health and the environment from the Site contamination will be reduced to acceptable levels specified in the National Oil and Substances Pollution Contingency Plan. A Baseline Human Health Risk Assessment was performed for the Site to determine these risk levels, which are reported in the Proposed Plan. According to the Risk Assessment report, the workers and residents who use the new recreational facility will not be exposed to elevated risk levels after the remedial acton is implemented.

D. Groundwater Monitoring Program

1. A local official inquired if the groundwater monitoring locations were close enough to the Coraopolis water supply well field to provide adequate information on contaminant migration to the Borough's drinking water supply.

Response: The groundwater monitoring program required in this Record of Decision was designed to ensure that the Coraopolis public water supply is protected from Site contamination. The monitoring program includes analysis of samples collected from monitoring points along the Back Channel side of the island, beneath the Main and Back Channels of the Ohio River, and at the Coraopolis public water supply well closest to the Site. This monitoring program will continue until contaminants in the Site groundwater plume reach the required cleanup levels. The results obtained from the monitoring program will allow EPA to determine whether contaminants are migrating from the Site before the contamination could reach the Coraopolis well field.

2. A local official inquired what would happen if contamination from the Site was identified in the Coraopolis water supply wells and who would be responsible for cleaning up the contamination.

Response: If contaminants from the Ohio River Park Site are detected in the Coraopolis water supply wells, the Record of Decision requires that an active groundwater extraction and treatment system be installed at the Site to contain the contaminated groundwater and prevent further migration of contamination from the Site. If Neville Land Company agrees in a consent decree to implement the ROD for OU-3, they will be responsible for any further requirements. EPA could issue a unilateral order requiring them to implement this ROD, or EPA could undertake the required actions and seek to recover costs from the Site owner/operators.

3. A local official asked whether the contaminated groundwater could be avoided if new Coraopolis water supply wells were installed upriver from the existing Coraopolis well field.

Response: The groundwater modeling performed for OU-3 investigated increased pumping rates and draw down from the existing Coraopolis well field. The modeling did not investigate alternate well locations.

4. A resident asked who will be responsible for sampling the monitoring wells and what laboratories will be used to analyze the samples.

Response: EPA anticipates that Neville Land Company will agree to collect the water samples from the monitoring wells. EPA representatives will also collect samples at a certain percentage of the monitoring points to ensure that good quality data are being generated. An EPA-approved laboratory will analyze the samples.

5. A resident asked if contamination had been detected on residential property adjacent to the Site.

Response: No contamination has been detected on adjacent residential property.

6. A resident inquired if the groundwater monitoring program proposed under Alternative 3 includes an assessment of the drinking water pumped from the Coraopolis well field and whether such moruitoning is required to operate a public water supply system.

Response: Public water suppliers are required to routinely monitor the quality of water provided to consumers under the Safe Drinking Water Act. The monitoring program required in this Record of Decision will provide additional information to allow evaluation of whether contaminants from the Ohio River Park Site are migrating toward the Coraopolis public water supply well field. The drinking water sampling results collected from the Coraopolis wells will be reviewed along with the data collected from the groundwater monitoring wells. This information will be made available to Coraopolis to meet any public water supply system requirements.

7. Residents from Coraopolis and Moon Township requested copies of the groundwater monitoring data generated as part of the implementation of Alternative 3.

Response: The groundwater sampling results collected as part of the required monitoring program will be made available to the public upon request from EPA.

E. Decision Process

1. A resident asked whether EPA had made a decision about the cleanup of OU-3 or if a decision would be made during the public meeting.

Response: EPA does not make a final decision on the appropriate remedy for a Site until after the public has had an opportunity to comment on its recommendation. A public comment period on the OU-3 Proposed Plan was held from February 25, 1998 to March 26,1998. EPA held a public meeting on March 17, 1998 to provide the public an opportunity to comment on the Proposed Plan directly to EPA. After these comments were received and reviewed, EPA, in consultation with PADEP, made a decision on the appropriate cleanup alternative for OU-3. That decision is documented in this Record of Decision.

2. A resident asked whether EPA would allow the Neville Island residents to select the cleanup option that will best protect human health and the environment.

Response: According to the Superfund law, EPA must consider community acceptance as part of the process for selecting a cleanup alternative. In order to reach as many local residents as possible to comment on the OU-3 Proposed Plan, EPA advertised the public meeting in the Coraopolis Record, the Pittsburgh Post-Gazette, and the Pittsburgh Tribune Review. EPA also mailed over 250 fact sheets on the Proposed Plan to local residents. While community acceptance is an important factor, it is only one of nine criteria that EPA must consider in selecting an appropriate remedy. EPA makes the final remedy selection decision.

3. A resident asked why construction is proceeding at the Site if all decisions have not yet

been made.

Response: The construction that is currently underway at the Site is for the new recreational facility being built on an uncontaminated portion of the Site. Work is also beginning on the multilayer cap installation required as part of the remedy selected in the OU-1 Record of Decision issued on September 30, 1996. The OU-1 remedy includes a multilayer cap, surface water runoff controls, monitoring, and institutional controls.

F. Property Acquisition

1. A resident asked whether Neville Land Company has purchased or plans to purchase any private or commercial property adjacent to the Site.

Response: EPA does not currently anticipate that Neville Land Company will need to purchase any property to implement the cleanup at the Site.

G. Positive Responses

1. Two state representatives expressed in writing their support for EPA's Proposed Plan and the redevelopment of the Site as a recreational facility. During the public meeting, several local officials from Neville Township stated their appreciation for EPA's and PADEP's efforts and dedication to ensure proper site cleanup and reutilization. The Cornell School District stated their support for EPA's Proposed Plan and appreciation of EPA's attention to the ongoing development of the Neville Island Sports Center.

Response: No response required.

III. TECHNICAL AND LEGAL ISSUES

This section provides responses to questions requiring a higher level of technical detail. Some of these questions were asked at the March 17, 1998 public meeting, however, most of them were received by mail, e-mail, or telephone during the public comment period.

A. General Groundwater Monitoring

1. PADEP requested that EPA's Proposed Plan include a thorough monitoring plan with specific triggers for contingency measures to determine whether natural attenuation will effectively protect human health and the environment.

Response: The remedy requirements identified in Section IX of this Record of Decision provide an appropriate level of detail to establish how successful implementation will be measured. The exact location and number of monitoring points will be determined during the remedial design process, however, the Record of Decision states which areas will be monitored. EPA Will provide the State with the opportunity to review and comment on the remedial design documents prior to EPA's approval.

2. PADEP expressed concern over the proposed number and location of the monitoring wells identified for Alternatives 2 and 3 in the Proposed Plan. PADEP feels that monitoring only the Back Channel will not adequately evaluate the effectiveness of the cap, changes in the water level and flow direction following installation of the cap, or the effectiveness of natural attenuation in eliminating groundwater contamination at the Site.

Response: EPA agrees with PADEP that additional monitoring points would provide more accurate data on the natural attenuation processes occurring at the Site and the effectiveness of the

remedy. EPA believes, however, that the monitoring program described in the Proposed Plan would provide information sufficient to identify general trends in contaminant levels in the groundwater plume and warn of potential threats to human health and the environment. Monitoring is not limited to the Back Channel, but includes a monitoring point beneath the Main Channel and at the Coraopolis well field. The Record of Decision does not establish the exact number and location of monitoring points. This information will be determined during the remedial design. EPA will provide PADEP with the oppontunity to review and comment on the remedial design documents prior to EPA's approval.

B. Groundwater Monitoring Parameters

1. Neville Land Company would prefer not to use the analytical detection limits for contaminants that are not detected during analysis when evaluating the monitoring results. NLC believes that using the analytical detection limits in the statistical analyses will lead to erroneous results, NLC suggests allowing a competent statistician to select the appropriate statistical tests and establish their data input needs.

Response: EPA Region III's Guidance on Handling Chemical Concentration Data Near the Detection Limit in Risk Assessments, dated November 4, 1991, will be used in determining how to handle sampling results that are below the detection limit. In general, a value of one-half the analytical detection limit is recommended. EPA has adopted this conservative approach to ensure that actions taken are protective of human health and the environment. Allowing a "competent" statistician to select the "appropriate" statistical test would create inconsistency in data analysis and lead to a complicated and prolonged remedial design review process as NLC, EPA, and PADEP statisticians debate the merits of different approaches.

2. Neville Land Company recommended defining the analytical parameters for the monitoring program identified in Alternative 3 during the final design process.

Response: While EPA agrees that additional information may be needed to appropriately determine the exact number and location of monitoring points, EPA had determined that the studies performed during the intinsic remediation demonstration study have adequately documented the analytical parameters that should be monitored to evaluate the ongoing natural attenuation processes at the Site. Therefore, this Record of Decision does identify the analytical parameters required in the monitoring program. Note, however, that EPA is willing to reevaluate both the frequency of sample collection and the analytical parameters required after the first three years of data collection.

3. Neville Land Company recommended that future monitoring program modifications for Alternative 3 be based on actual needs at the time that they are made.

Response: See previous response.

4. PADEP recommended that the monitoring list of parameters for Alternative 3 include all contaminants of concern. This includes semi-volatile organic compounds and dissolved metals. PADEP believes the list of parameters should be identical for a monitoring wells for statistical evaluation. After three years of monitoring, Neville Land Company could then petition EPA to remove certain parameters if warranted by statistical evaluation.

Response: EPA has determined that samples collected from monitoring points on the Site shoreline along the Back Channel should be analyzed for the full range of potential contaminants (i.e., VOCs, SVOCs, and metals) as well as the natural attenuation parameters. EPA will consider reducing the analytical parameters required at these monitoring points after the first three years of sample collection. At monitoring locations not currently impacted by the Site

groundwater plume, EPA has determined that a reduced set of parameters is appropriate. If conditions at the Site change, EPA can require that additional analytical parameters be added to the monitoring program.

5. PADEP noted that the contaminants of ecological concern in the groundwater, which are identified on page 11 of the Proposed Plan, should correspond with the list of parameters that will be monitored.

Response: Samples collected from the Site shoreline along the Back Channel will be analyzed for VOCs, SVOCs, and metals, Analyses for pesticides and PCBs are not required because these parameters were not identified as contaminants of concern in the groundwater.

6. PADEP expressed concern about the overall duration of the monitoring period. Specifically, PADEP feels that the overall duration should be clearly defined for each alternative of the Proposed Plan.

Response: The selected remedy identified in Section IX of the Record of Decision requires that monitoring be performed until the groundwater cleanup levels for the Site are achieved.

7. PADEP requested that all natural attenuation indicator parameters (dissolved oxygen, nitrate, manganese II, iron II, sulfate, methane, redox potential/Eh, alkalinity, and pH) be included in the monitoring parameters for Alternative 3. PADEP recommended that the list of natural attenuation parameters for Alternative 3 be constant throughout the entire monitoring period. Natural attenuation is a continuing process and various natural attenuation parameters may be depleted or increased in different areas of the groundwater plume at different times. For statistical comparisons and evaluations of natural attenuation, it is important to have a uniform list of natural attenuation parameters.

Response: EPA included the list of natural attenuation parameters requested by PADEP. EPA will consider changes to the list of parameters following the first three years of sample collection at the Site. The impact on statistical comparisons of datasets will be a factor considered in determining whether to change the list of required natural attenuation parameters.

8. PADEP expressed concern over the use of sulfate as a tracer and a natural attenuation indicator for Alternative 3. Sulfate has been historically related to wastes dumped at the Site, which should be taken into consideration.

Response: PADEP's concerns over the historical presence of sulfur wastes at the Site will be taken into account during future monitoring. Presence of sulfur wastes at the Site, however, is considered by EPA as a modifying factor, which should not exclude sulfate from the list of natural attenuation parameters. EPA was aware of the distribution of sulfur wastes at the Site during its review of the intrinsic remediation demonstration study. Nevertheless, EPA considers sulfate an important parameter in the evaluation of natural attenuation at the Site.

C. Intrinsic Remediation Demonstration Study

1. PADEP expressed concern that the intrinsic remediation demonstration study did not adequately determine the actual mass loading of the contaminants of concern to the Ohio River and the Back Channel. The actual mass loading should be computed in accordance with PADEP requirements for surface water instream criteria set forth at 25 Pa. Code 250.309.

Response: More thorough evaluation of mass loading is presented in the Feasibility Study. This study provides the data that water quality in the Ohio River is not impaired by the additional contaminants of concern. EPA agrees that the intrinsic remediation demonstration study selectively addresses some aspects of the mass loading. This approach is, however, sufficient to issue the ROD pertaining to natural attenuation of the groundwater.

2. PADEP expressed concern over the aquifer narrative in the Proposed Plan and believes that the inference that contaminated Site groundwater is not moving towards the Coraopolis well field, but rather follows the gradient of the Ohio River, is not substantiated by the intrinsic remediation demonstration study potentiometric maps or the concentration contour maps. PADEP asserts that the gradient of the Ohio River is not the only influence on groundwater movement at the Site. PADEP agrees that groundwater appears to be discharged to the Back Channel and/or is naturally attenuated or diluted before it contacts the well field. However, PADEP believes that the intrinsic remediation demonstration study did not address the degree to which discharge/dilution versus biodegradation/natural attenuation is acting as the predominant factor in protecting the well field.

EPA Response:

EPA based its decision on the intrinsic remediation study, submitted by Neville Land Company, which was verified by EPA expert, John Wilson, Ph.D. of the Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma. Dr. Wilson used his own modeling program to check the pace of natural attenuation at the Site and concurred with the conclusions of the intrinsic demonstration study.

3. PADEP questioned the validity of statements in the Proposed Plan which indicate that the contaminant plume will be stabilized through capping and natural attenuation. PADEP feels that the implied message is that the plume will be stabilized and contaminant discharge to the river will stop. Since the intrinsic remediation demonstration study did not include an analysis of what the Site is discharging to the river, PADEP contends that any definitive statements on the reduction or elimination of contaminant discharge to the river cannot be supported.

Response: EPA does not consider the statement in the Proposed Plan to be "definitive". The entire issue of natural attenuation is based on historical data, selective sampling, modeling, and experts opinions. It is therefore possible that the results of long-term monitoring may differ from scientific predictions. Further sampling and evaluations would narrow the margin of error; however, EPA considers the existing data to be adequate to make the decision expressed in the ROD.

D. Other

1. Neville Land Company recommended removing the discussion concerning the need to include a warning sign to fisherman. A requirement relating to such signage has already been incorporated into the Record of Decision for OU-1, and available data does not confirm or suggest that the Site has had any actual impacts upon fish within the Ohio River. Therefore, Neville Land Company believes it is inappropriate for the warning sign to be a requirement in the Record of Decision for OU-3.

EPA Response: EPA agrees that the institutional control requirements in Section IX.C of the Record of Decision are the same as those required under Section X.H. of the OU-1 Record of Decision. However, EPA has included these requirements in this Record of Decision as well to ensure that these controls are maintained throughout the duration of the actions required in

both Records of Decision.

2. PADEP recommended that the Commonwealth's Act 2, The Land Recycling and Environmental Remediation Standards Act, and 25 Pa. Code Chapter 250, Section 250.304 (Regulations for Administration of the Land Recycling Program (Act 2)) be included as chemical-specific ARARs.

EPA Response: EPA included the Act 2 medium-Specific concentrations ("MSCs") for groundwater as Chemical Specific ARARs for any contaminant of concern for which an MCL under the Safe Drinking Water Act does not exist.

3. PADEP disagrees with figures in the Proposed Plan which show that the benzene plume is shrinking. PADEP asserts that these figures are based on analytical results from 1981, 1984, 1987, and 1993, and represent benzene concentrations in different wells and different zones from various monitoring events. PADEP does not, therefore, believe that the figures should not be portrayed as definitive depictions of the benzene plume.

Response: The figures presented in the Proposed Plan and in this Record of Decision include the compilation of currently available data. The monitoring results presented in these figures serve general investigation purposes and the figures were generated to evaluate the natural attenuation processes occurring at the Site, The phenomenon of natural attenuation had not yet been recognized when these data were collected. EPA does not consider this data as the definitive presentation of the historical limits of the benzene plume but rather as one of many documents supporting a finding that natural attenuation is occurring at the Site.

4. PADEP indicated that the Commonwealth's requirements at 25 Pa. Code Chapter 16, Water Quality Toxics Management Strategy, and 25 Pa. Code Chapter 93, Water Quality Standards, should be included as chemical-specific ARARs for the Site.

   EPA Response: EPA included these ARARs as identified in the ROD.

5. PADEP questioned the ownership of the property as stated in the Proposed Plan. Similarly, PADEP is not convinced that a portion of the property that was never owned by Neville Land Company could be transferred to Neville Land Company.

Response: The Neville Land Company did not recommend any changes to the discussion of their ownership of the Site presented in the Proposed Plan. Therefore, EPA did not alter this language in this Record of Decision. During EPA's investigation of the Site, EPA perfonned a title search to determine the ownership of the Site. On August 21, 1997, NLC forwarded to EPA a copy of the deed from Allegheny County, dated May 12, 1997, transferring title for the remaining parcel to NLC.